Electrical World

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Now ACCURACY IN RUGGED MOVING IRON VANE AND DYNAMOMETER INSTRUMENTS

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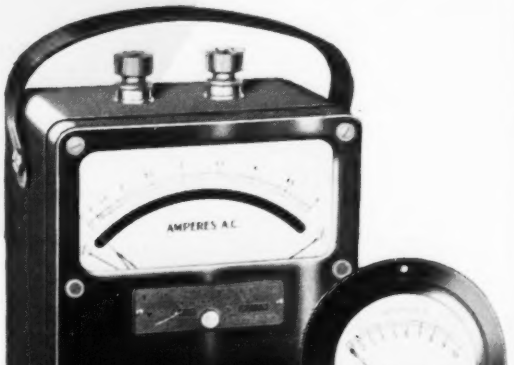

WESTON
FREQUENCY COMPENSATED INSTRUMENTS

This is another WESTON contribution born of war's needs, wherein the growing use of equipment operating in the higher power frequency range necessitated instruments of *broad flexibility* plus the *rugged dependability* which moving iron vane and dynamometer instruments provide.

And throughout industry today, the growing use of power frequencies above 60 cycles, with the smaller transformers, higher speed motors, simpler rectifier filter systems, makes the use of these instruments essential for their dependable indications and for their economy as well.

Weston is furnishing these instruments as ammeters, voltmeters, and wattmeters, in both portable and switchboard types; flat compensated up to 1000 . . . 2000 . . . 3000 cycles for general laboratory use, as well as for specific application to electronic and power apparatus. Weston Electrical Instrument Corporation, 628 Frelinghuysen Avenue, Newark 5, N. J.

Weston *Instruments*

ALBANY • ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • JACKSONVILLE • KNOXVILLE • LOS ANGELES • MERIDAN
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Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 71 YEARS

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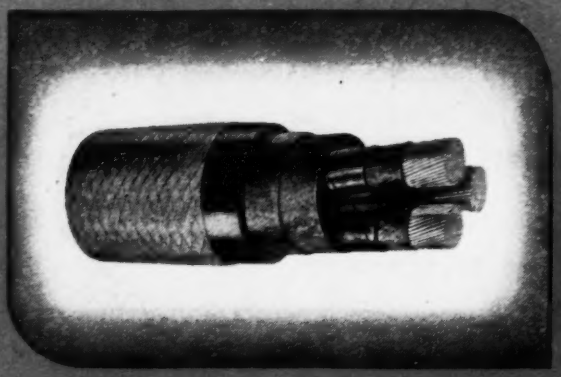
OKONITE "FIRSTS" FOR THE NAVY

- First to offer a corrosion-resistant lead alloy coating for copper conductors ("Okoloy")
- First to develop a method of assembling conductors to increase resistance against twisting ("Unilay")
- First to supply conductors insulated with a non-flammable synthetic dielectric ("Okoseal")
- First to protect conductors with flame-resistant glass fiber insulation ("Okoglass")
- First to manufacture the synthetic impervious sheath for protecting cables ("Okoseal")

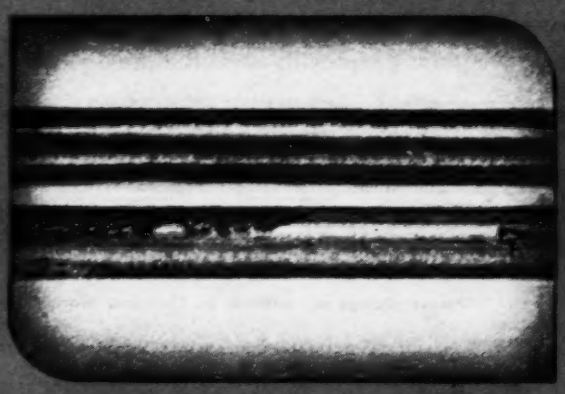
they ALL benefit ALL industry

Meeting Navy demands has been more than a challenging experience to Okonite chemists and research engineers. It has helped to introduce better products of greater value to all industry. Among Okonite's pre-war developments in electric cable and insulated wire are many which have been improved and which have found their greatest usefulness in wartime. Some of them whose service advantages have commercial applications are listed and illustrated. Write for further information on any or all of them or for assistance on any specific problem involving the transmission or distribution of electrical power through insulated wires and cables. The Okonite Company, Passaic, New Jersey.

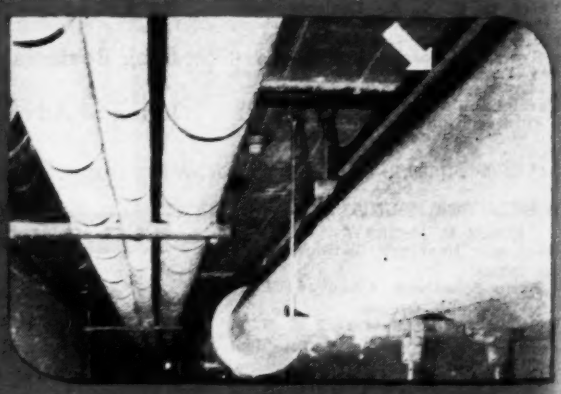
OKOSEAL as wire insulation is moisture-tight, non-flammable, resistant to chemicals, oils, and ozone.



OKOSEAL as a flexible sheath, in addition to the above advantages, is light in weight and mechanically strong.



OKOLOY affords a corrosion-proof lead alloy conductor coating that outlasts tinning at least 2 to 1. Okoloy (top) is unaffected by immersion.



OKOGLASS insulation, which cannot burn or give off flammable gases, protects cables in hot locations, as near steam lines.

OKONITE insulated wires and cables

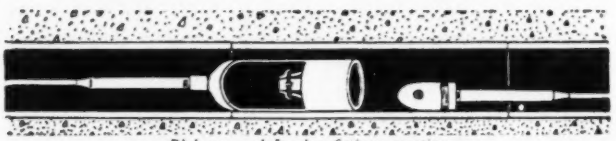
Thirty minutes or two weeks?

Utilities have found that one gang, with Electroline Steel Duct-Rodding Equipment, can make a half-hour job out of one that formerly took two gangs two weeks with old-style equipment!

In consequence, they have made amazing savings in labor cost alone. Add to this lower first cost, the lower handling cost, and longer life . . . then you have their reason for adopting Electroline's speedy, economical Duct-Rodding Equipment.

The construction is simple and trouble-free, yet affords the outstanding advantages of easy, efficient rodding and great durability in service.

You can turn days into minutes, too—by speeding up installation and cutting costs with Electroline Duct-Rodding Equipment. Get full details and prices . . . write for a copy of descriptive Bulletin 939.

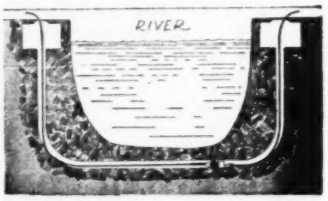


Pick-up and Leader fittings meeting.

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

PATENT APPLIED FOR



Electroline Company

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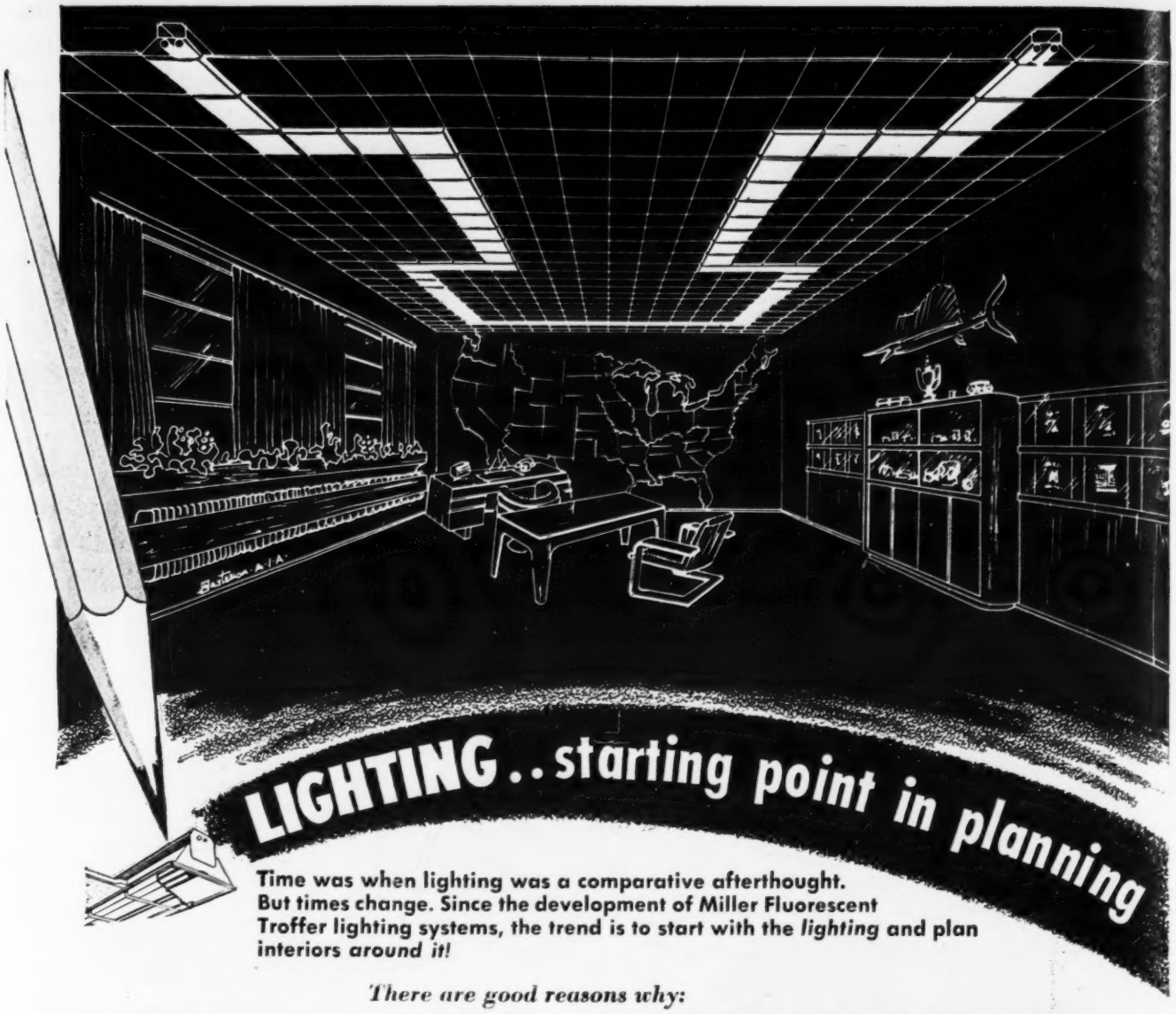
CHICAGO, ILLINOIS



LIGHTING .. starting point in planning

Time was when lighting was a comparative afterthought. But times change. Since the development of Miller Fluorescent Troffer lighting systems, the trend is to start with the *lighting* and plan interiors *around it!*

There are good reasons why:

1. Miller Fluorescent Troffer lighting systems simplify planning. They are engineered to meet structural problems.
2. They *suggest* themes around which to plan the entire structure. They are readily installed in single units, blocks, geometric patterns or light-strips "by the mile".
3. They harmonize with all interiors. There is a wide range of glass or plastic lenses, plates, and metal or plastic grilles to meet specific architectural and lighting requirements.
4. They simplify construction. Instead of laboriously fitting a lighting system into false ceilings, the patented Miller Bracket makes it possible to hang the ceiling *directly from* the lighting system.

But how about the *lighting qualities* of Miller Fluorescent Troffer lighting systems?

For 100 years, The Miller Company has pioneered in lighting. It works with all approved light-sources, including mercury-vapor and incandescent. The Miller Company believes that Fluorescent Troffer lighting systems are its very *finest* achievement.

Miller distributors and field engineers are conveniently located to serve you.

OTHER PLUSSES
OF MILLER FLUORESCENT TROFFER LIGHTING SYSTEMS:

- Supports from structural ceiling reduced 50 to 75%.
- Conduit and conduit fitting costs reduced up to 80%.
- Wiring costs reduced up to 50%.
- Permanent operation and maintenance economies.

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

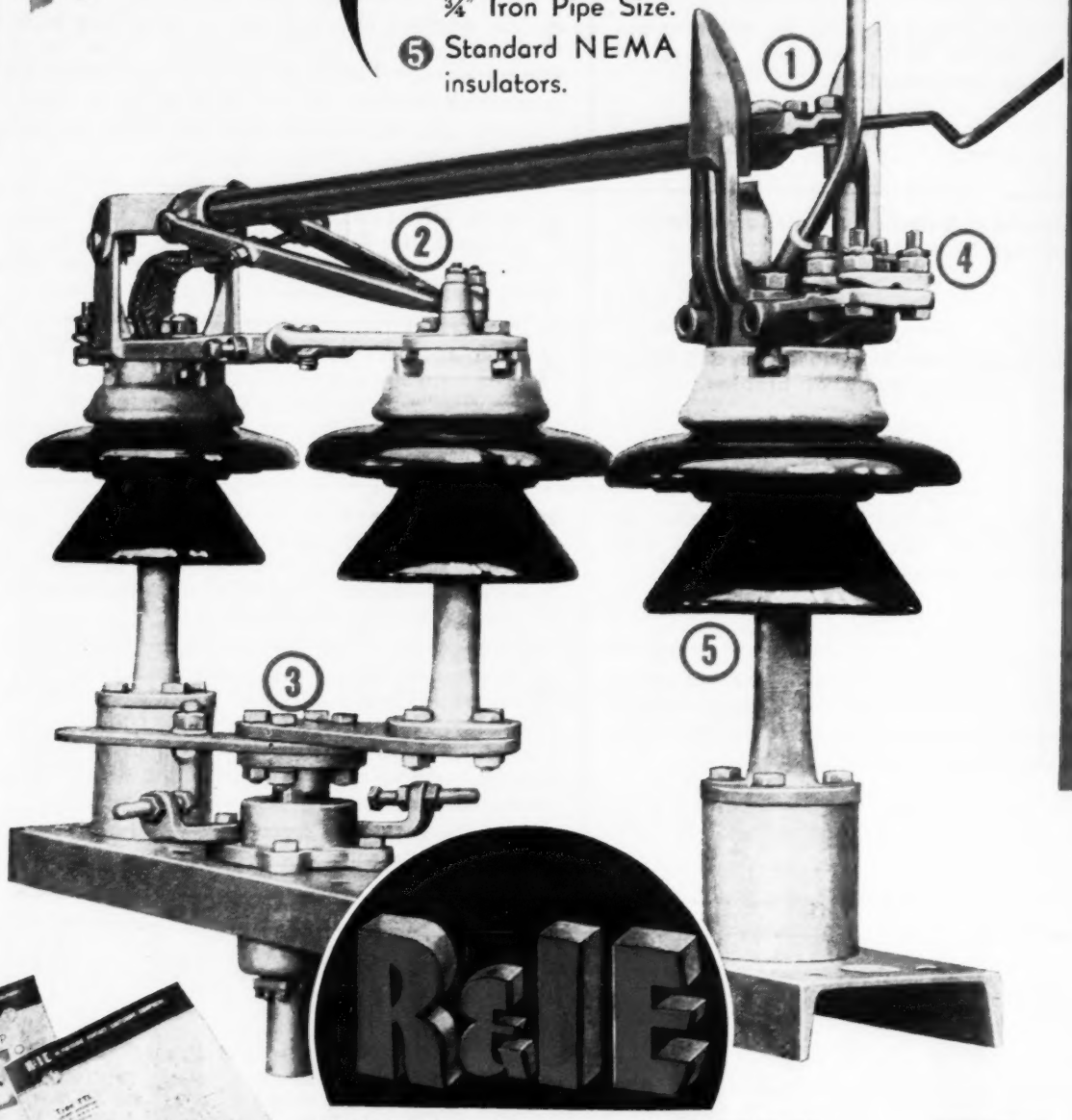
ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

CHECK the FACTS

1. HI-PRESSURE, self-cleaning contacts — one piece jaw and terminal.
2. Few, rugged, non-ferrous parts. Simple, easy operation.
3. Weather-sealed, greaseless, anti-friction bearing using a forged rotor for maximum strength.
4. Clamp type terminal, "TC" or "UC" universal, using 4 half-inch bolts on 1¾" x 1¾" NEMA drilling. . . .
   Supplied for conductor up to ¾" Iron Pipe Size.
5. Standard NEMA insulators.



The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

R&IE

DETAILS IN BULLETIN 1331

HORN GAP SWITCH *Type* TTL

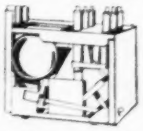
RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

BRANCH IN CANADA — EASTERN POWER DEVICES, LIMITED, TORONTO

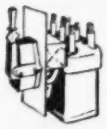
Modernization

Utilities Want	Allis-Chalmers Offers
1 Reduced interrupting time, which increases system stability by reducing period of system disturbances under fault conditions . . . builds customer goodwill.	**1** A COMPLETE LINE of quick-clearing (8 cycle) oil circuit breakers, Ruptor-equipped for lightning-quick arc interruption, is offered by Allis-Chalmers. Fault-clearing within 5 cycles is provided by Ruptors in the *BZO-60* circuit breaker, for ratings of 115 kv and higher. Compact, coordinated operating mechanisms assure fast and trouble-free operation of A-C circuit breakers.
2 Greater interrupting capacity, for meeting increasingly severe duties imposed by system growth and load concentrations.	**2** FOR GETTING increased capacity in existing breaker structures, Allis-Chalmers offers to install modern Ruptors — which keep arc energy low, decrease tank pressures, *slash maintenance time and costs.* NOTE: All Allis-Chalmers oil circuit breakers above 50,000 kva rating are Ruptor-equipped.
3 More operations between maintenance periods . . . to cut service costs.	**3** FIELD AND LABORATORY tests show that breakers equipped with Ruptors have far less contact burning and oil carbonization — are capable of many more operations without maintenance.
4 Ability to handle severe reclosing cycles up to maximum reclosing rating of breaker.	**4** LOW ARC ENERGY release obtained with Ruptors gives assurance that an Allis-Chalmers circuit breaker will repeatedly reclose and reopen a severe fault within its rating without distress or excessive deterioration of contacts or oil.
5 High dielectric strength, enabling breaker to withstand surges caused by switching and faults without deterioration of dielectric level.	**5** DIELECTRIC STRENGTH of Allis-Chalmers circuit breakers is always equal to or exceeding the latest NEMA and AIEE Standards. All bushings have the capacity to withstand mechanical impacts, as well as stresses due to high inrush currents.
6 Ultra-rapid reclosing of breakers on important high voltage overhead lines — for greater service continuity and to avoid unnecessary duplication of transmission lines.	**6** PNEUMATIC OPERATORS, with reclosing time as fast as 20 cycles, are available on Allis-Chalmers outdoor circuit breakers rated over 15 kv, 500,000 kva. Compressed air gives quick reversal of moving parts — maximum closing speed throughout the stroke. Equipment is reliable and easy to maintain. High-speed solenoid operators — either a-c or d-c — are also available.

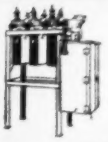
E-145 — 200-400 amp, 2500 volts, 15,000 kva int. cap.



AB Line — Indoor air blast; 15 kv, up to 500,000 kva.



D-20 — 600-1200-2000 amp, 5 kv, 50,000 kva.



O Line — 7.5 to 46 kv, 50,000 to 250,000 kva.

FZO-150 — 15 to 69 kv, 500,000 to 1,500,000 kva.

ALLIS CHALMERS *makes a*

Chart

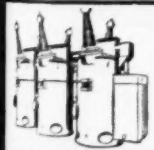
OIL CIRCUIT BREAKER FACTS FOR SYSTEM PROTECTION PLANNERS

Utilities Want	Allis-Chalmers Offers
7 **Precision protective relaying, for greater accuracy and dependability.**	**7** BUSHING CURRENT TRANSFORMERS of generous cross-section can be provided in all Allis-Chalmers outdoor circuit breakers . . . minimizing ratio error.
8 **Mechanical stability of operating parts, insuring correct operation at all times.**	**8** PERMANENT MECHANICAL adjustment is a feature of Allis-Chalmers breakers. Adjustment is factory-checked before shipping—maintained during installation and operation by rigidly-braced stationary members and husky movable members. Stop nuts and other reliable locking means are used throughout the breaker structure.
9 **Less maintenance on contacts — minimum contact replacement.**	**9** FOR LONGER LIFE, moving and stationary contacts on Allis-Chalmers breakers are of special arc-resisting alloys, while main contacts are liberally silver-surfaced. Arcing contacts are massive. Ruptors minimize arcing, *greatly lessening contact wear.*
10 **Complete circuit breaker weatherproofing — for protection of breaker operating parts and for greater safety.**	**10** RECOGNIZING the importance of breaker weatherproofing, Allis-Chalmers has designed the *FZO-150* outdoor oil circuit breaker, with compact, smooth, all-welded steel top . . . giving maximum protection against wind-driven sand, snow, sleet, and water. All external conduits have been eliminated . . . bushing transformer wiring is run in isolated ducts incorporated into the top frame. For more detailed information on the complete A-C line of oil circuit breakers, call our nearby district office. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

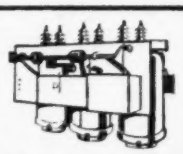
REMEMBER — Allis-Chalmers now makes oil circuit breakers with these up-to-date features:

- ☑ **Ruptors designed for 5-cycle opening of larger outdoor breakers.**
- ☑ **Pneumatic operators, for ultra-rapid (20-cycle) reclosing.**
- ☑ **Modern high-speed solenoid operators, for increased system stability.**
- ☑ **"Unitop" weatherproof construction on streamlined outdoor breakers.**

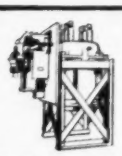
A 1836



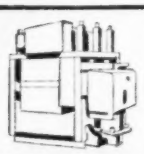
BZO-60 — 115 to 230 kv, 1,000,000 to 2,500,000 kva.



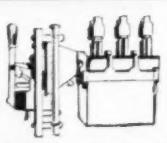
FZ Line — 15 to 34.5 kv, up to 2,500,000 kva.



DZ Line — Up to 2000 amp, 15 kv; 100,000-500,000 kva.



AM Line — Magnetic air; 5 kv, up to 150,000 kva.



E-47 — 400-600-800 amp, 5 kv, 25,000 kva int. cap.

Full Line of Circuit Breakers

LET THESE TIME-PROVED FEATURES

work for you!

Standard

TRADE MARK

Cover gasket of treated cork gives complete moisture-proof seal and prevents oil leakage. Each unit pressure tested.

(Not shown) Tank support lugs solidly welded to rear of tank for direct pole mounting. Jump-proof lips formed on upper lugs. Will accommodate cross arm hangers.

Tank of copper-bearing steel with seams electrically welded.

Tapped pad for grounding secondary neutral to tank.

Tapped pad for grounding tank. (Not shown)

Core assembly of non-aging, low-loss, varnish coated silicon steel sheets, sheared and annealed to reduce core losses.

Steel T-bars welded to tank for easy insertion or removal of element assembly. Prevent movement in tank.

(Not shown) Nameplate pad positioned and designed in accordance with ASA standards. Space provided for users plate.

Cover readily removed by loosening and rotating hold-down fingers. Entire interior is thus exposed.

Removable low voltage stud type bushings with approved solderless connectors.

Pressed steel overhanging pocket electrically welded to tank gives protection to porcelain bushing.

High voltage pocket type bushings are brown glaze, wet process porcelain with solderless connectors. Coordinated so that flashovers will occur externally rather than internally.

Porcelain tap-changing block, connections easy to see and change.

Clamps bolted to T-bar prevent vertical movement of element assembly.

Lifting ring for easy handling of element assembly.

Well-designed core clamping assures quiet and efficient operation.

Coil wound in two sections doubles heat radiation. Ends not blanketed, thus inducing free and effective oil circulation.

Recessed flanged bottom provides extra mechanical strength and prevents damage in handling.

Write

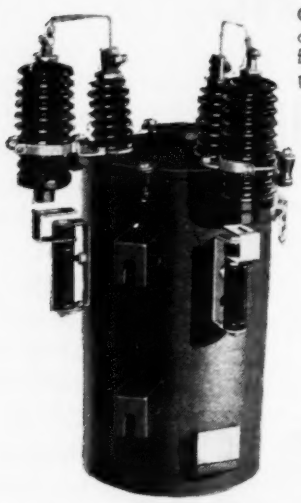
for full information on Standard Transformers of the sizes and types used on your properties.

STANDARD TRANSFORMER CO

DISTRIBUTION TRANSFORMERS

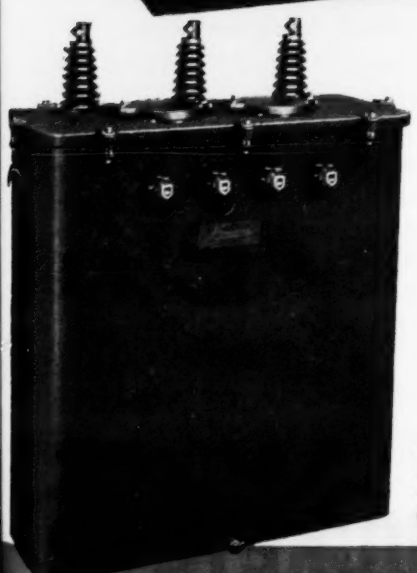
250 KVA, three phase transformer. Special rollers (A) shown on bottom of tank is an example of STANDARD engineering to meet individual specifications.

STANDARD 150 KVA transformer rated 4800 to 120/240 volts using welded on radiators for cooling.

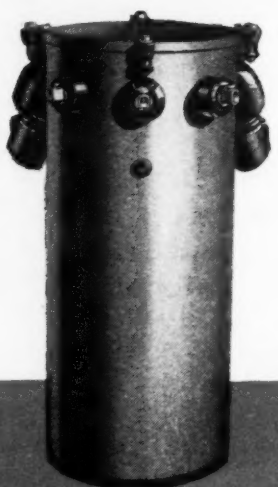


Completely Self Protected type, with cover stud type high voltage bushings for 7200 volt service. Also made with pocket type high voltage bushings.

Typical construction of STANDARD round tank distribution type. Cover mounted or side wall pocket type high voltage bushings offered. Designs are all in full accord with ASA standards.



25 KVA, three phase unit, 6900 to 120/208Y volts. Fits many applications where space is limited and effects economies in installation.



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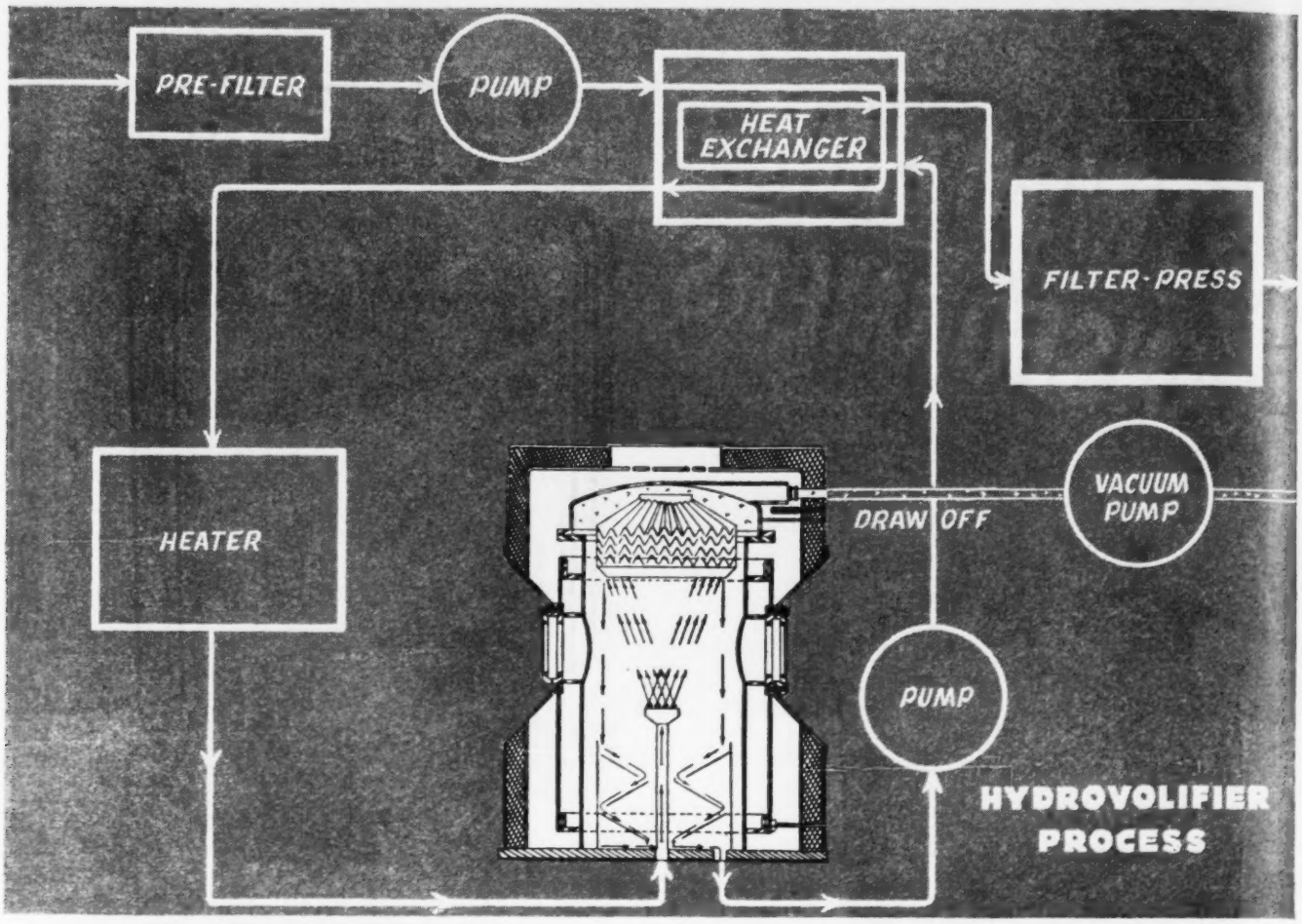
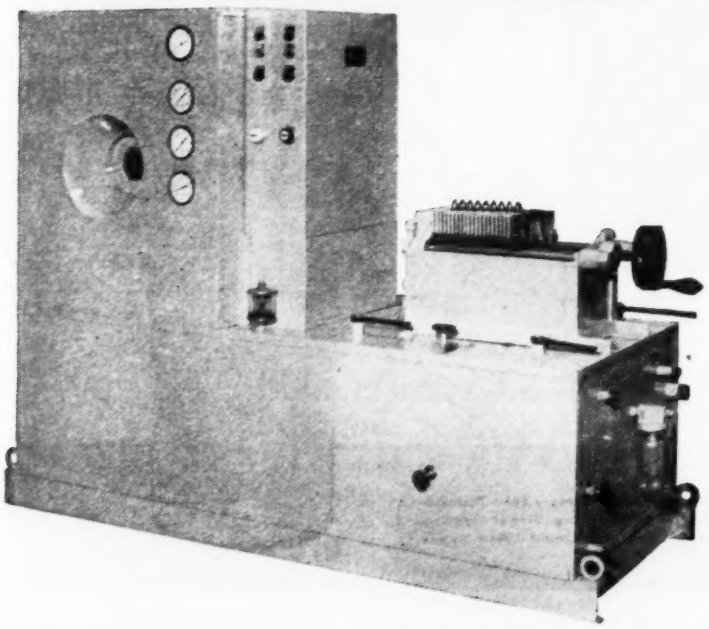
REPRESENTATIVES IN PRINCIPAL CITIES (Makers of Transformers for: Distribution, Power, Metering, Street Lighting, Testing. Dry and Liquid Filled Types.)



To Keep INSULATING OIL *free from* MOISTURE-AIR *and harmful* ACIDS



OIL IS SERVICED IN A SINGLE PASS through the apparatus. Following the flow chart above, oil passes from pre-filter to pump—to heat exchanger—to heater—to spray chamber—to pump—to heat exchanger—to filter press—back to transformer or to storage.

A CLOSED SYSTEM. In the Buckeye Process oil is treated at low temperature under high vacuum. No air comes in contact with oil during processing.

A PORTABLE, COMPACT MACHINE Permits servicing of transformers in place without service interruptions.

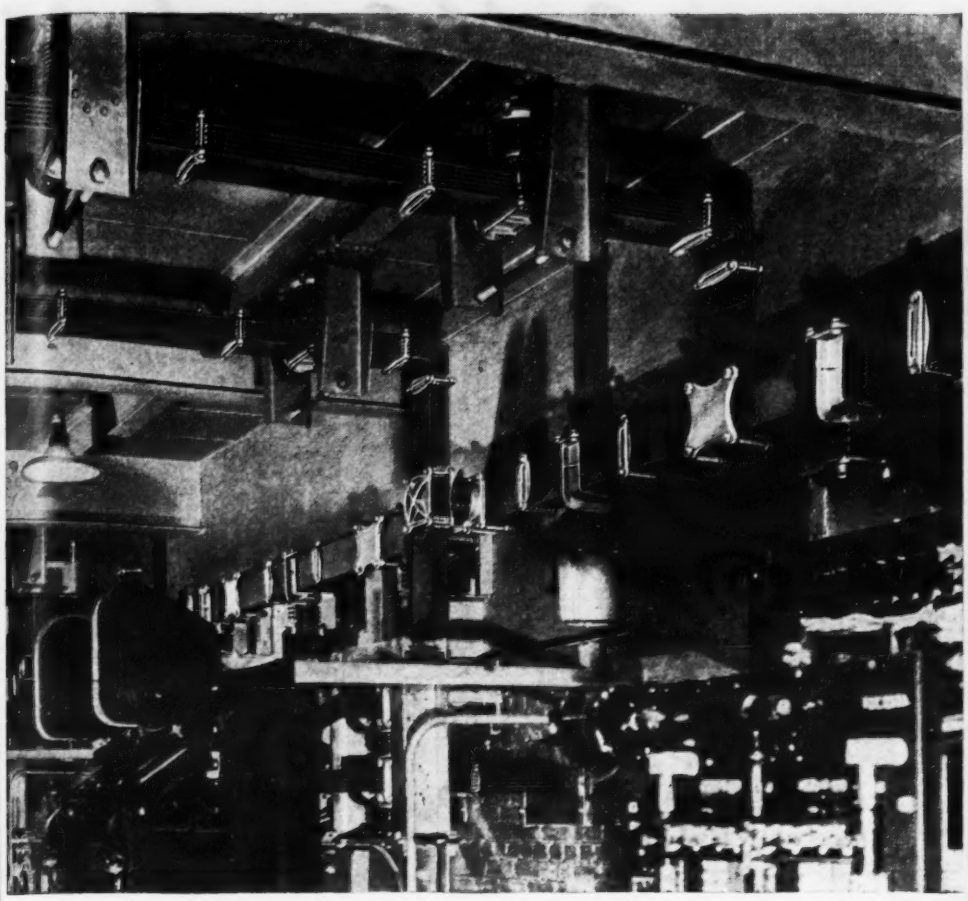
SIMPLE, AUTOMATIC OPERATION. Only three connections are made — the inlet and outlet lines and power circuit. Temperatures and pressures are automatically controlled.

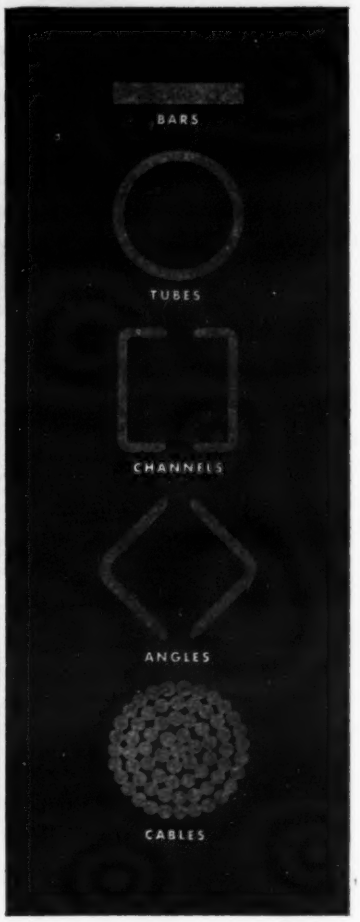
CONTINUOUS PROCESS. Oil from transformer flows through Hydrovolifier is returned to transformer in a continuous circuit.

LARGE CAPACITY. Three standard sizes—100 gal. per hr.—300 gal. per hr.—500 gal. per hr.
Write for Hydrovolifier bulletin.

BUCKEYE
LABORATORIES CORPORATION

1965 E. 66th St.
CLEVELAND 3, OHIO





Low-Loss Anaconda Bus Conductors

FOR EVERY POWER TRANSMISSION REQUIREMENT

WHEN there's electric power to transmit, COPPER offers long-recognized advantages. High conductivity (both electrical and thermal) . . . strength . . . high corrosion resistance and moderate cost make copper the logical choice for bus installations.

There's an Anaconda Copper Bus Conductor shape for every transmission requirement. Send for Bus Conductor Booklet, C-25, or consult with The American Brass Company Technical Department.

BARS requiring minimum space may be bent or twisted, connected to apparatus without special joint preparation, and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS with large surface area and ventilation feature, reduce temperature rise, have greater rigidity for long runs than tubes, flat surfaces for tap-off.

ANGLES for ventilated hollow busses with highest rate of heat dissipation, handle greater current density but require more space for installation.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as arc or resistance furnaces.

BUY WAR BONDS
Saved Dollars mean Saved Lives.

ANACONDA

Anaconda Copper

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

1 Pill for 9 Headaches!

PAGES FROM "A GUIDE TO WARTIME CARE OF ELECTRIC MOTORS"

Electric Motor Enemy No. 1 . DUST
Electric Motor Enemy No. 2 . . . STRAY OIL
OIL IS QUICK TO ATTACK INSULATION WHEN IT REACHES IT.
Electric Motor Enemy No. 3 . . . MOISTURE
Electric Motor Enemy No. 4 . . . FRICTION
Electric Motor Enemy No. 5 . . . MISALIGNMENT
Electric Motor Enemy No. 6 . . . VIBRATION
VIBRATION SHAKES THE LIFE OUT OF MOTORS
Electric Motor Enemy No. 7 . . . UNEVEN WEAR
YOU EXPECT WEAR AT SOME POINTS . . .
Electric Motor Enemy No. 8 . . . OVERLOAD
LIKE AN OVERLOADED HORSE, A MOTOR WORKED BEYOND ITS HORSEPOWER CAPACITY IS SURE TO BREAK DOWN
Electric Motor Enemy No. 9 . . . UNDERLOAD

ALL NINE electric motor enemies are present and accounted for in Allis-Chalmers' new "Guide to Wartime Care of Electric Motors." Streamlined instructions and story-telling pictures describe what they are, where they're found, how to fight them.

Designed for wartime U. S. industry, "Guide to Wartime Care of Electric Motors" has aroused such world-wide demand that Spanish and Portuguese editions are now printing!

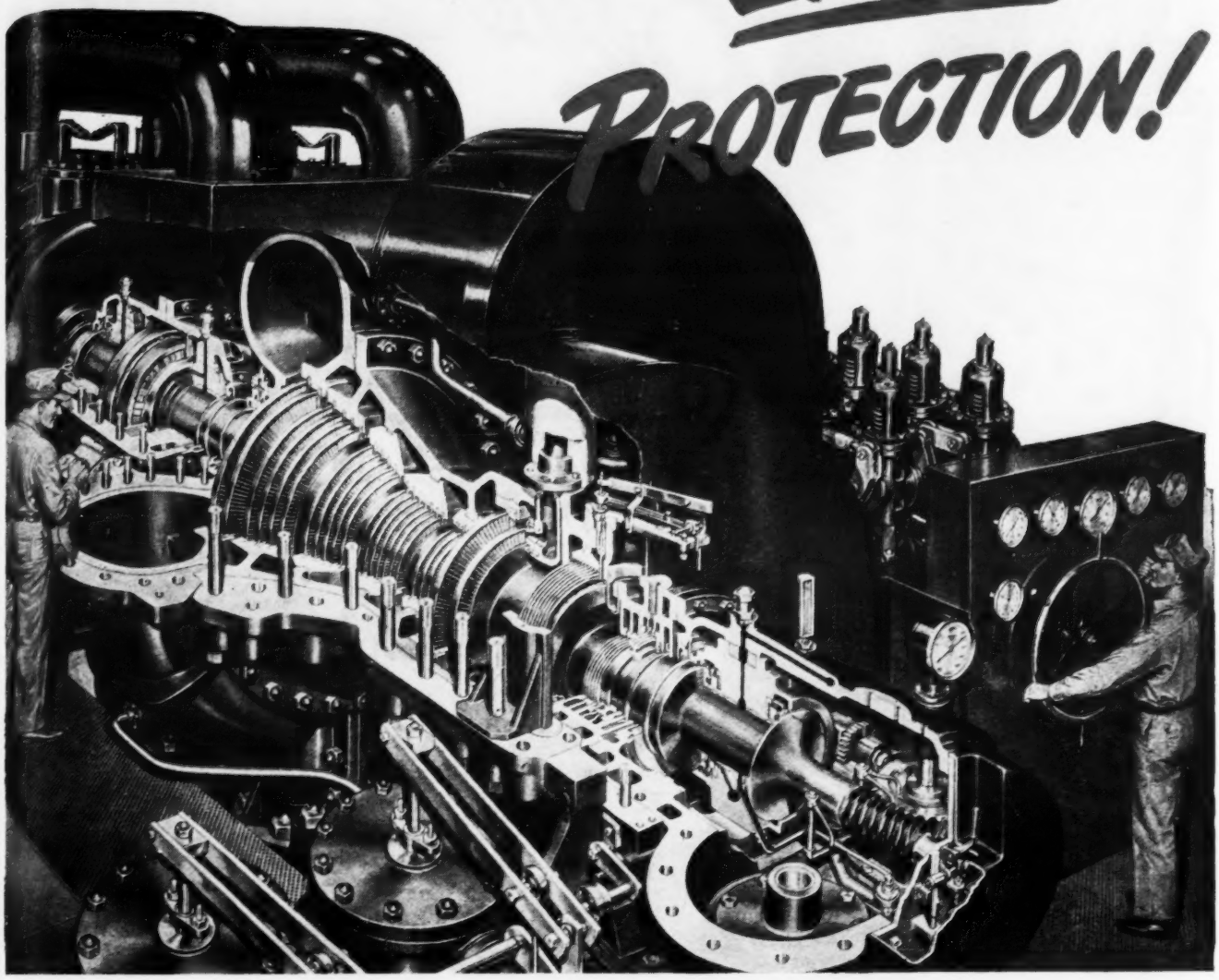
You'll find this valuable new handbook ideal both for training new men and "brushing up" old hands. It contains no advertising. Write today for *your* free copy of this tremendously successful handbook to ALLIS-CHALMERS MFG. CO., MILWAUKEE, WISCONSIN. A 1625

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

AC WE WORK FOR VICTORY WE PLAN FOR PEACE

Give your Turbine this EXTRA PROTECTION!



THIS unique cutaway drawing of a giant 200,000 h.p. turbine shows far better than words why you need *something extra* in your turbine oil.

Socony-Vacuum's great new turbine oil—Gargoyle D.T.E. Oil 797—gives you this something extra. This new oil adds *extra* resistance to oxidation and rust, to a high-quality base stock that is in itself an excellent turbine oil.

In severe tests, Gargoyle D.T.E. Oil 797 has stood up far longer than any other turbine oil. Now, it's in service in turbines ranging in size from 1500 KW, to 50,000 KW.

Get full performance facts and figures on Gargoyle D.T.E. Oil 797, from your Socony-Vacuum Representative. Then, give your turbine this *extra protection* for *extra performance*.

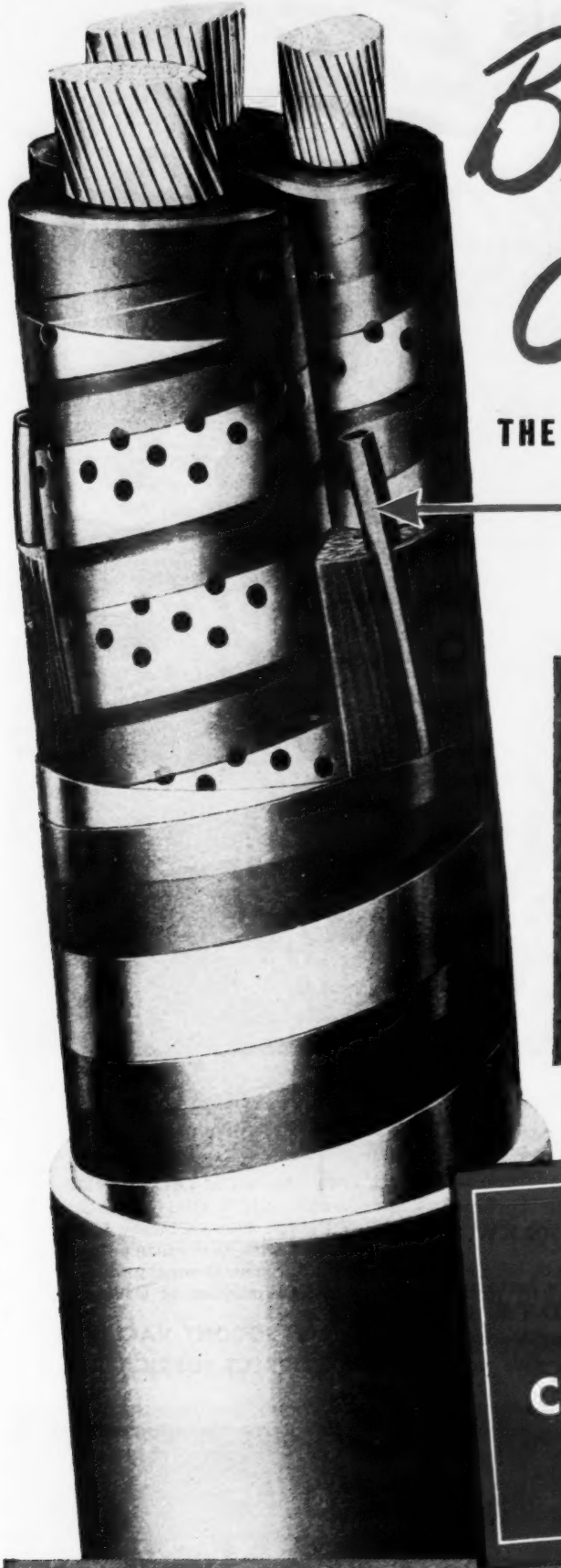
SOCONY-VACUUM OIL CO., INC.
Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. • White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California.

CALL IN SOCONY-VACUUM FOR "CORRECT LUBRICATION"

GARGOYLE Lubricants

GARGOYLE D.T.E. OIL 797

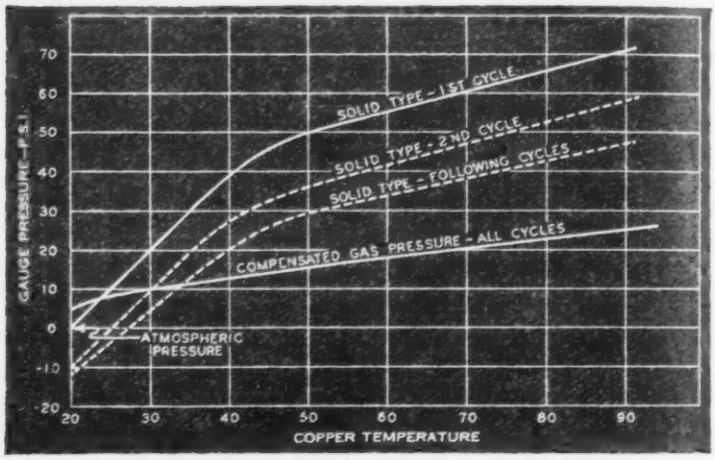
TUNE IN "INFORMATION PLEASE"—MONDAY EVENINGS, 9:30 E.W.T.—NBC



Better Engineered...

THE GAS CUSHION STABILIZES PRESSURES

WITHIN FIXED LIMITS IN THIS NEW PAPER INSULATED POWER CABLE



Solid Cable versus Type PC. A comparison of internal pressures under load.

TYPE PC PRESSURE COMPENSATED CABLE

USS STEEL
UNITED STATES STEEL

Other products of American Steel and Wire Company

- Amerclad Portable Cable
- Amerbestos Cable
- Amerductor Transmission Line
- Amarine Submarine Cable
- Reliance Weatherproof Wire
- P. S. Shielded Cable

to insure maximum heat-cycle life!

IMPROVED mechanical design, thorough impregnation, and "unique gas cushion" are the features in this new paper cable.

When the loads are applied and cable temperatures go through wide gyrations, manifold gas cushions absorb expanding oil and stabilize internal pressure within fixed and narrow limits. Uniform pressures exist along cable length regardless of contour. Thorough initial saturation and uniform pressure above atmospheric, preclude void formation with resulting ionization discharges and rapid deterioration of paper and insulating compounds. The latter are chosen for their stability and optimum viscosity characteristics rather than for "waxing" and "self-healing" properties.

Type PC Pressure Compensated Cable is an outstanding development in the long history of American Steel & Wire Company electrical wire and cable manufacture. It was designed to provide maximum reliability in transmission of power commensurate with reasonable first cost. Disadvantages of old types of cable have been eliminated without the introduction of new or inadvertent faults.

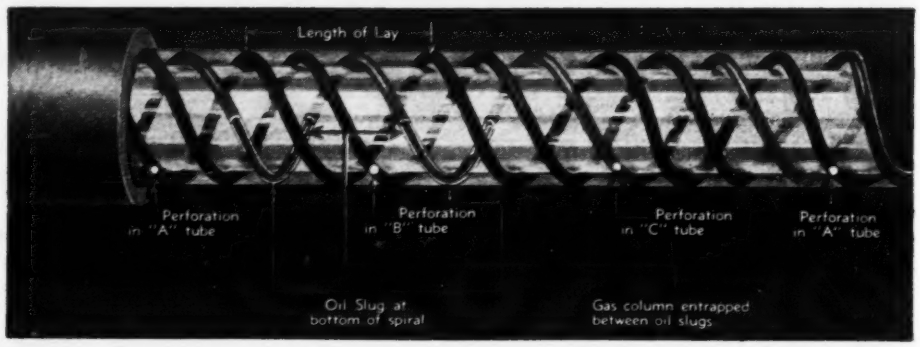
Type PC Cable will fit into your existing system and most certainly can be used for contemplated lines. Our engineers will help you in applying it and will give instructions for installation and maintenance. Write for a copy of our bulletin on Pressure Compensated Cable.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

How PRESSURE COMPENSATED CABLE works


Length of Lay
Perforation in "A" tube
Perforation in "B" tube
Perforation in "C" tube
Perforation in "A" tube
Oil Slug at bottom of spiral
Gas column entrapped between oil slugs

In Type PC Pressure Compensated Cable, a gas cushion provided by one or more small tubes included in the impregnated fillers, stabilizes operating pressures within fixed limits. The schematic diagram above shows clearly how it functions.

The helical tubes, perforated at intervals of about four times the length of lay, are filled with dry nitrogen gas. During manufacture, some of the insulating compound is forced into the perforations.

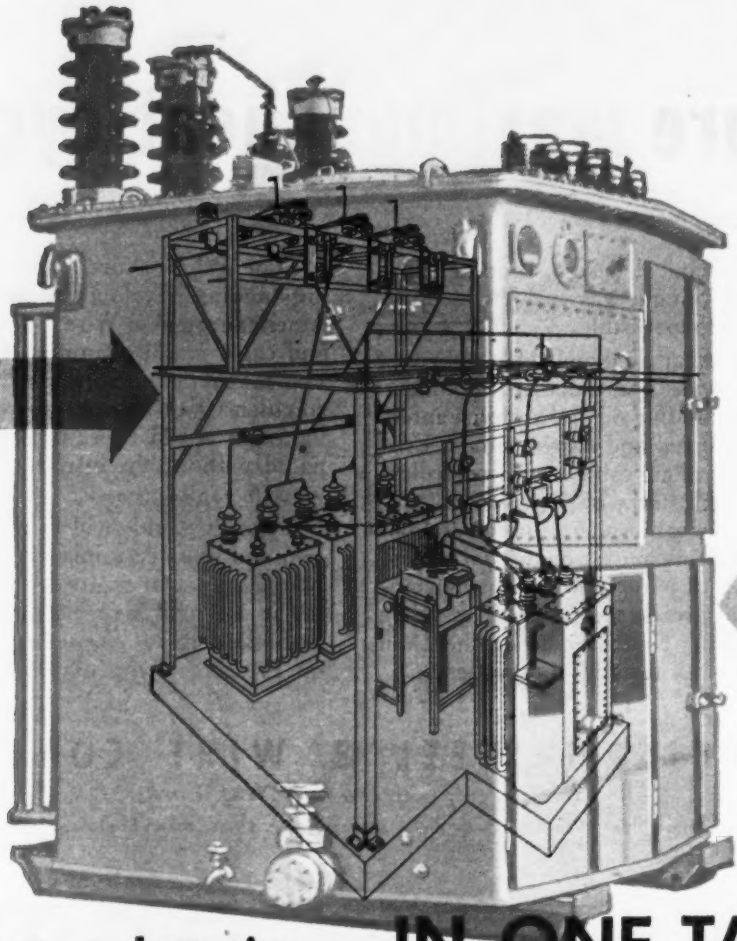
After the cable is installed, slugs of the compound gradually collect in the low portions of the tubes and the gas collects in the domes.

As the cable heats up under load, the compound expands and additional compound is forced into the tubes. The gas trapped between the slugs is compressed and thus acts as a cushion to prevent development of internal pressures which would ordinarily stretch the lead sheath.

In this way, points of concentrated pressure are avoided. Pressure remains uniform and evenly distributed along the entire cable.

When the cable cools, the oil saturant contracts and the compressed gas forces the excess oil back into the cable, thus preventing wide swings from pressure to vacuum.

UNITED STATES STEEL



a complete substation . . . IN ONE TANK!

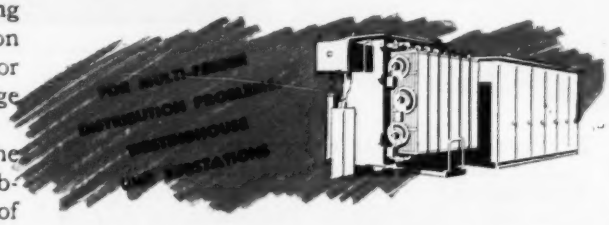
One unit . . . one order . . . one shipment . . . one installation! Westinghouse CSP Power Transformers provide a quicker, more efficient—*and more practical*—answer to any distribution problem involving a need for single-feeder substations. .

Because "everything is in one tank", they not only simplify ordering and coordinating the equipment, but also reduce installation man-hours by 75%. It is easy to move or relocate substations as load centers change . . . with 100% salvage value!

CSP Power Transformers perform all the functions of a conventional single-feeder substation. They are one of the several forms of "Packaged Power" equipment designed by Westinghouse to simplify and expedite the ordering and installation of coordinated power equipment. For more details, write today for your copy of booklet B-3468, "Packaged Power". Westinghouse Electric & Manufacturing Co., P. O. Box 868, Pittsburgh 30, Penna. J-70453

WHAT IS PACKAGED POWER?

Packaged Power is the modern and efficient way of buying, installing and operating electric power distribution equipment. In addition to the unit shown above, Westinghouse Packaged Power is available in the following forms:



Westinghouse PACKAGED POWER

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

PRODUCT IMPROVEMENT THROUGH

DURONZE

...FOR CONNECTORS WHICH MUST NOT FAIL

The operating efficiency and safety of outdoor electrical installations—power and communication lines, electric and street railway overhead systems, signal devices, substations, radio transmitter stations—all are dependent upon the strength and reliability of connectors, bolts, nuts and pole line hardware. For these are the parts subjected to high mechanical stresses and exposed to the corrosive actions of the elements!

Duronze alloys high strength, corrosion resistant silicon aluminum bronzes —are especially suited for severe outdoor service. Bolts made from Duronze V— (silicon bronze) wire by the cold heading and roll threading process average more than 100,000 p.s.i. and retain their original strength because they do not waste away from rust.

Duronze III,—(silicon aluminum bronze) averages more than 90,000 p.s.i. in the annealed condition and is excellent for making nuts and screw machine parts of connectors and electrical hardware.

Bridgeport engineering alloys can bring improvement to your products. Write today on company stationery for the "Duronze Manual." This free booklet contains 80 pages of data, charts, and tables that will prove valuable to you.

BRIDGEPORT BRASS COMPANY

BRIDGEPORT 2, CONN.

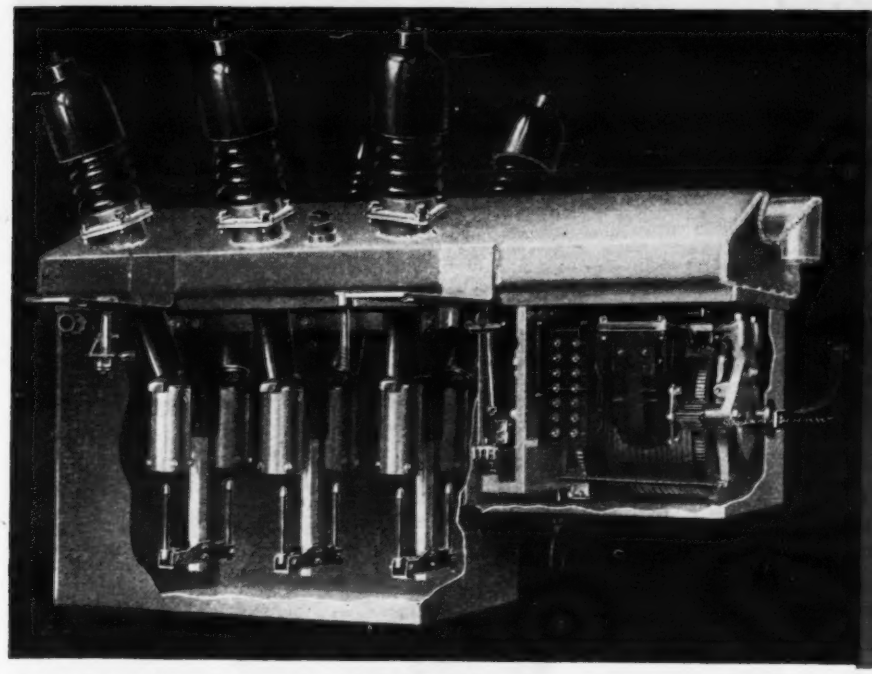
Established 1865

Electrical Connector illustrated above was furnished through the courtesy of Jasper Blackburn Products Corporation.

Duronze Alloys—PRODUCTS OF

BRIDGEPORT BRASS

Want IMMEDIATE FAULT CLEARANCE

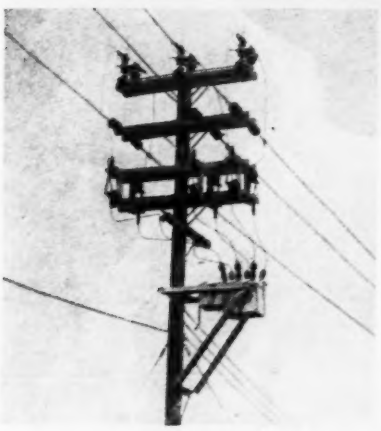


for RURAL or Low-Revenue Distribution Lines?

Take a Look

AT PACIFIC ELECTRIC'S *Motor-Rewound* **AUTOMATIC SERVICE RESTORER**

Type AP-40, 100 Amperes Continuous, 1800 Amperes Interrupting Rating, 15-kv.



You Get Three-Reclosure Protection Before Lockout on Sustained Faults

MOST FAULTS are TEMPORARY. But fuses blow just the same. Long outages follow.

You can clear any number of such faults *immediately* with this Automatic Service Restorer.

When a transient fault occurs, the pre-wound spring in the Service Restorer automatically and immediately opens and recloses the circuit. After the first reclosure, a 115-volt motor starts rewinding the spring, taking 60 seconds rewinding time for the energy expended in each reclosing operation. If faults are 60 seconds apart, the spring is always fully wound — giving 3-reclosure protection at all times before lockout which occurs on sustained faults.

There is a choice of reclosing intervals, also easy outside adjustments of current and inverse-time-delay tripping. Emergency manual operation is provided

Arcs clear rapidly because this Automatic Service Restorer has the well-known Pacific Electric Expulsion Contacts. Fast arc extinguishment permits fast opening and reclosing. Oil and contacts last longer.

By clearing any number of transient faults immediately, you save outage time and line patrolling just as scores of other utilities are doing. One utility reports that one of these motor-Rewound Automatic Service Restorers cleared 242 faults in 8 days, during a sleet storm, without lockout.

Ask for a look at the full and interesting details about this Automatic Service Restorer, Type AP-40.

C. H. CUTTER
1015 Securities Bldg. Seattle 1, Wash.

PIERCE G. FREDERICKS
90 West St. New York 6, N. Y.

J. E. REDMOND CO.
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Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO 24, CALIF. P. O. BOX 419, GARY, INDIANA

except

ELECTRICITY and FIRE INSURANCE

TWO NOTABLE EXCEPTIONS TO THE GENERAL TREND

Yes, your industry and ours share the unusual distinction of steadily reducing costs to the consumer, over a long period.

Since 1913, the National Average cost of residential electric service has been reduced almost 59%.

In the same period, the average cost of Fire Insurance has been reduced by more than 40%, regardless of fluctuating fire loss ratios, which are now heading upward.

The Electric Light and Power Companies of America and the Capital Stock Fire Insurance Companies of America are two outstanding examples of business enterprises which reduce the cost to the consumer while improving service.

We amend our famous poster to say Nearly Everything Costs more today, *except Electricity and Fire Insurance.*

1792 PROTECT WHAT YOU HAVE

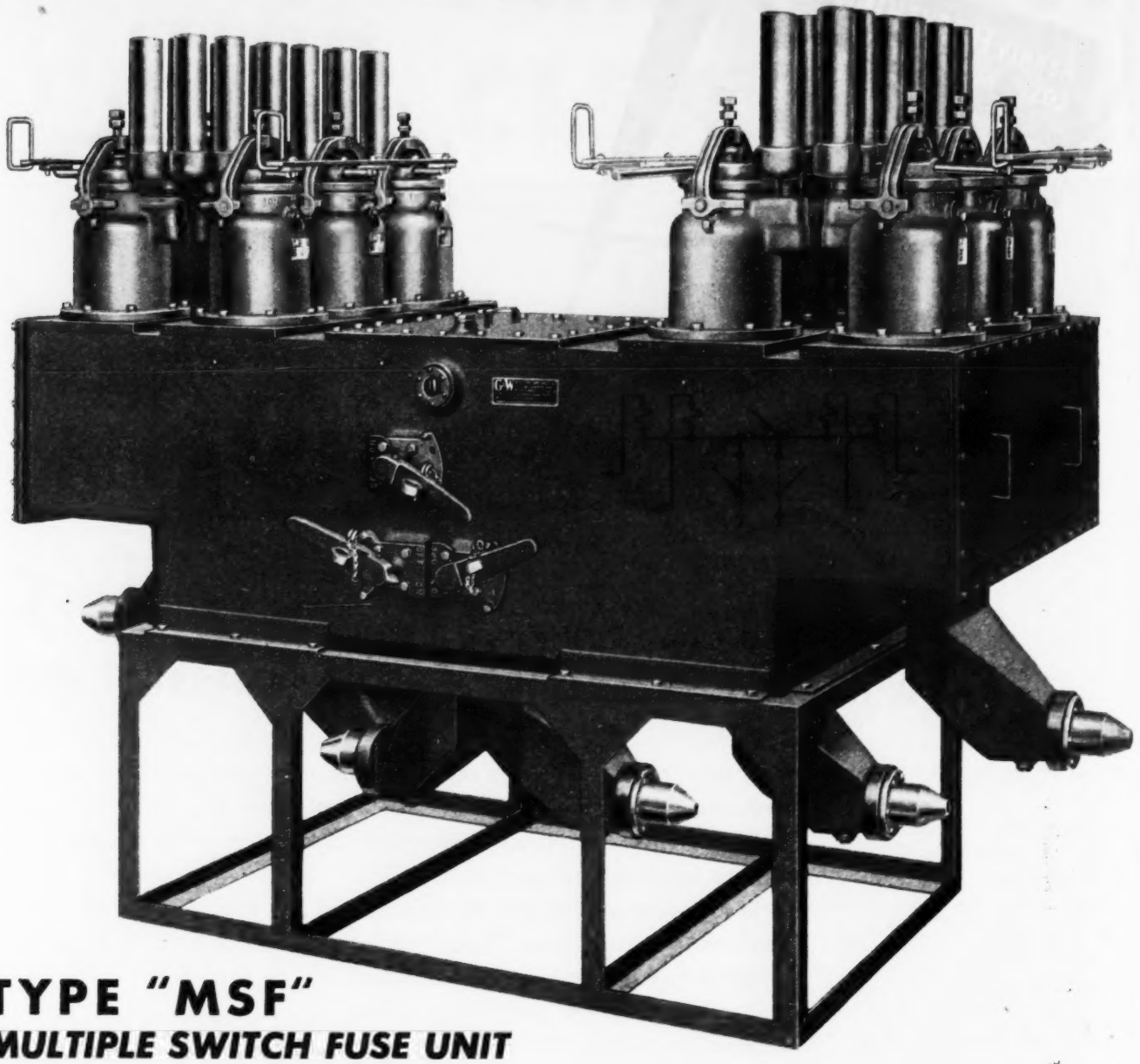
INSURANCE COMPANY OF NORTH AMERICA COMPANIES, *Philadelphia*

INSURANCE COMPANY OF NORTH AMERICA
THE ALLIANCE INSURANCE COMPANY OF PHILADELPHIA
CENTRAL INSURANCE COMPANY OF BALTIMORE
INDEMNITY INSURANCE COMPANY OF NORTH AMERICA
NATIONAL SECURITY INSURANCE COMPANY
PHILADELPHIA FIRE AND MARINE INSURANCE COMPANY

Head Office: 1600 Arch Street, Philadelphia 1, Pa. • Service Offices throughout America • Agents everywhere

KEEP AMERICA BUSY — GIVE A RETURNED VETERAN A JOB!

G&W SWITCH-FUSE UNITS . . . provide maximum flexibility and protection to cable circuits



TYPE "MSF"
MULTIPLE SWITCH FUSE UNIT

COMBINES:

TYPE "RA" OIL DISCONNECTS
for two feeds and bus.

TYPE "FC" OIL FUSE CUTOUTS
for four load circuits.

Fully metal enclosed factory built unit using standardized parts—

- *Saves space and installation labor.*
- *Water-tight subway construction.*
- *Simple and safe to operate.*

The two loads on each side can be supplied independently by one of the feed circuits or all four loads can be supplied from either or both feeds. Each load circuit is protected against overloads and short circuits by the OIL FUSE CUTOUTS—and can be switched on and off at full load by the gang operating mechanisms.

Write us or our nearest representative for further data.

G&W ELECTRIC SPECIALTIES

Originators and pioneers of equipment for sound methods of underground and overhead electric distribution.

G&W ELECTRIC SPECIALTY CO.
7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.

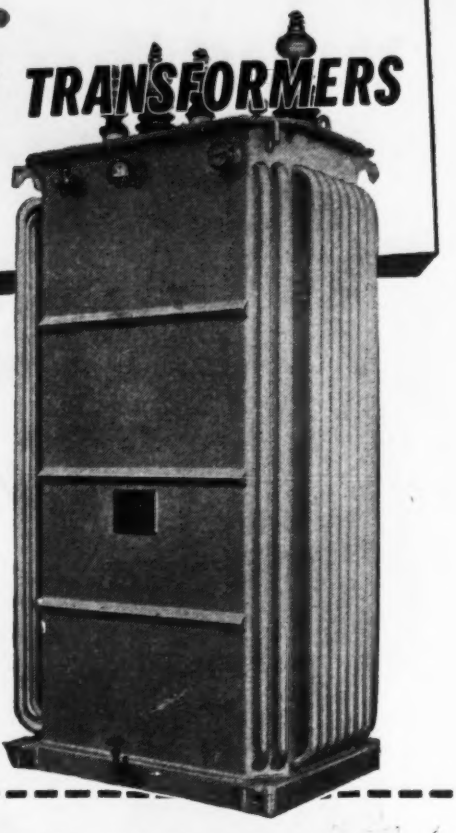
Potheads . . . Boxes . . . Oil Fuse Cutouts . . . Oil Switches . . . Multitaps . . . Splicing Kits

In Canada—Powerlite Devices, Ltd., Toronto, Canada

Wagner

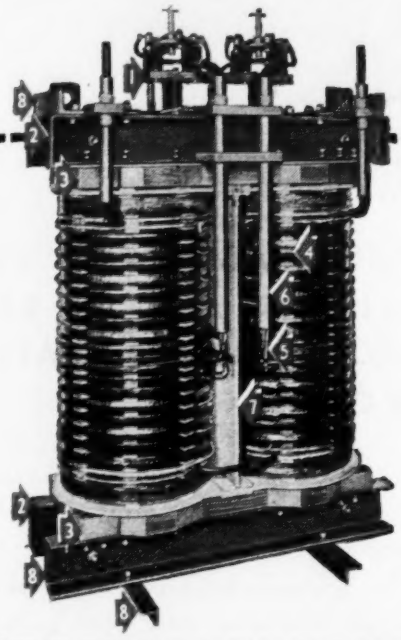
Single-Phase DISTRIBUTION TRANSFORMERS

provide a *plus* combination of superior characteristics . . .



Thousands of Wagner transformers are winning their "service stripes" under the heavy stress of present wartime loads. Wagner transformers have a fine reputation for being able to stand up in service—and there are many reasons, too many to list in the space limitations of a single advertising message.

The features listed below are but a few of many reasons why Wagner transformers stay on the job under the severe operating conditions to be encountered today.



1. Tap-changers are mounted on fully-seasoned, vacuum-dried, oil-treated maple supports—to provide high dielectric and mechanical strength with proper alignment.
2. Top and bottom endplates and associated parts are made up of fabricated structural steel forms rigidly bolted together. All nuts are locked in place by means of pal-nuts or other approved shakeproof devices.
3. Coil-clamps of oil-treated maple effectively clamp the coils and prevent distortion under operating conditions.
4. High-voltage single-division coils are separated from each other by insulating washers.
5. Taps are brought out in the middle of the winding where they offer no real problem as far as weakening coils and causing breakdowns.
6. Tap-leads are grouped together and carried thru insulating tubes to the terminal-board or tap-changer. This procedure mechanically supports the leads in the space necessary for proper electrical clearances.
7. Barriers of heavy pressboard between the two legs of the windings prevent flashover.
8. The element is securely braced against horizontal and vertical shifting. The lower clamping members are extended to the dimensions of the tank; the top members are anchored to the tank walls.

   Low-voltage cylindrical-type coils are amply provided with oil-ducts passing through their entire length, assuring effective cooling throughout the winding.

   An insulating cylinder supplemented by an oil-duct on each side provides insulation between the high-voltage and the low-voltage coils.

TRANSFORMERS are but one of several **WAGNER PRODUCTS** serving industry.

Other **WAGNER PRODUCTS:**

AIR BRAKES
·
BRAKE LINING
·
HYDRAULIC BRAKES
·
INDUSTRIAL BRAKES
·
INDUSTRIAL BRAKE CONTROLS
·
TACHOGRAPH (Recording Speedometer)
·
ELECTRIC MOTORS

THESE 29 SALES AND SERVICE BRANCHES ARE READY TO SERVE YOU

For complete information on Wagner distribution transformers (or other types of Wagner transformers such as power, air-cooled, substation, rural-line, etc.) write to the address below or to the nearest of these 29 branches manned by trained field engineers who are ready to help you solve your transformer problems:

ATLANTA 3 • BALTIMORE 18 • BOSTON 15 • BUFFALO 8 • CHICAGO 16 • CINCINNATI 10
CLEVELAND 15 • DALLAS 1 • DENVER 2 • DETROIT 2 • HOUSTON 2 • INDIANAPOLIS 4
KANSAS CITY 8 • LOS ANGELES 15 • MEMPHIS 3 • MILWAUKEE 2 • MINNEAPOLIS 4
NEW YORK 7 • OMAHA 2 • PHILADELPHIA 8 • PITTSBURGH 13 • PORTLAND 9 • ST. LOUIS 3
SALT LAKE CITY 1 • SAN FRANCISCO 3 • SEATTLE 4 • SYRACUSE 2 • TULSA 3 • WASHINGTON 5

ARMY (E) NAVY — NATIONAL SECURITY AWARD

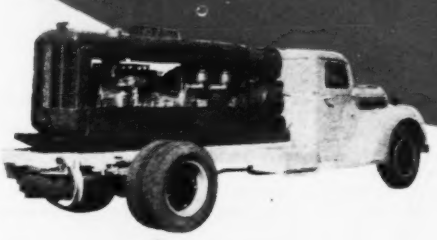
Wagner Electric Corporation

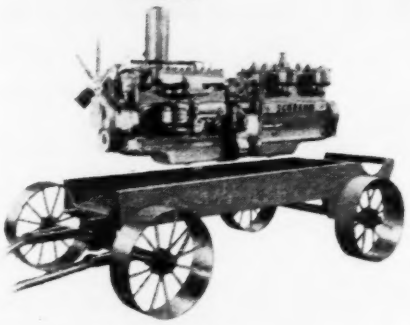
ESTABLISHED 1891

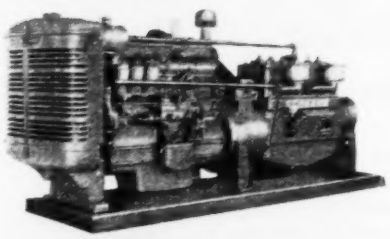
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.

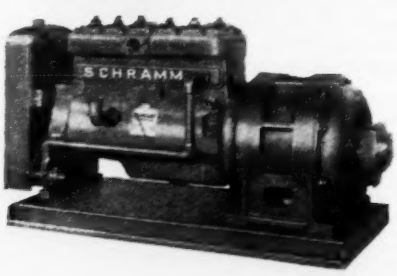
ELECTRICAL AND AUTOMOTIVE PRODUCTS

Compressed Air where you want it









THERE'S A SCHRAMM FOR EVERY COMPRESSED AIR JOB IN STEAM PLANTS . . . GENERATING STATIONS . . . FIELD WORK!

Four of the many types of Schramm Air Compressors are shown here. In every Schramm, all you have to do is push a button—and get all the compressed air you want!

This means there's a Schramm Air Compressor for Utilities no matter what the job. Schramm units, both portable and stationary, are extensively used by the utility field in general field service, repair shops, generating stations, and steam plants.

Schramm features include: (1) 100% water cooled to provide ideal performance both winter and summer (2) main bearings for every cylinder (3) mechanical intake valve (4) more cylinders and lighter parts (5) forced feed lubrication.

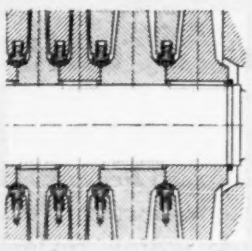
These, and other features, make Schramm the *preference* in leading industries, one being the Utility. Schramm offers so many savings, why not write for literature today. Ask for Bulletin #PUB—44.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA

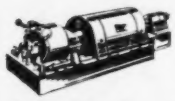
HENDY Turbine Labyrinth Seals are another dividend-paying feature

This simplified step-cut labyrinth steam seal is an exclusive feature of Hendy turbines that not only reduces interstage leakage but also contributes to shaft rigidity and rotor disk strength. A shorter and stronger turbine is possible with this method of sealing, since each disk is butted against the adjoining one.



The four-piece sealing blocks are soft leaded bronze, flexibly located, with leaf springs applying pressure from the diaphragm grooves. This feature in Hendy turbines contributes to longer operating life and higher over-all efficiency. Watch succeeding advertisements for other dividend-paying Hendy features.

When requesting data on Hendy turbines or turbo-generating plants please indicate type of service involved, electrical requirements, and steam conditions.



The development of this highly efficient steam-sealing method is the result of Hendy experience gained through the mass production of 4000, 6000 and 8500-hp turbines, and large numbers of turbo-generator sets for the Maritime Commission.

Simplified governor and speed control, and rocker-shaft operation of the valve mechanism are other Hendy turbine features. Combined with the labyrinth seals and simplification of design throughout the entire unit, they raise operating efficiencies and reduce maintenance and service problems. Two-color reprints showing details of these features are available upon your request.

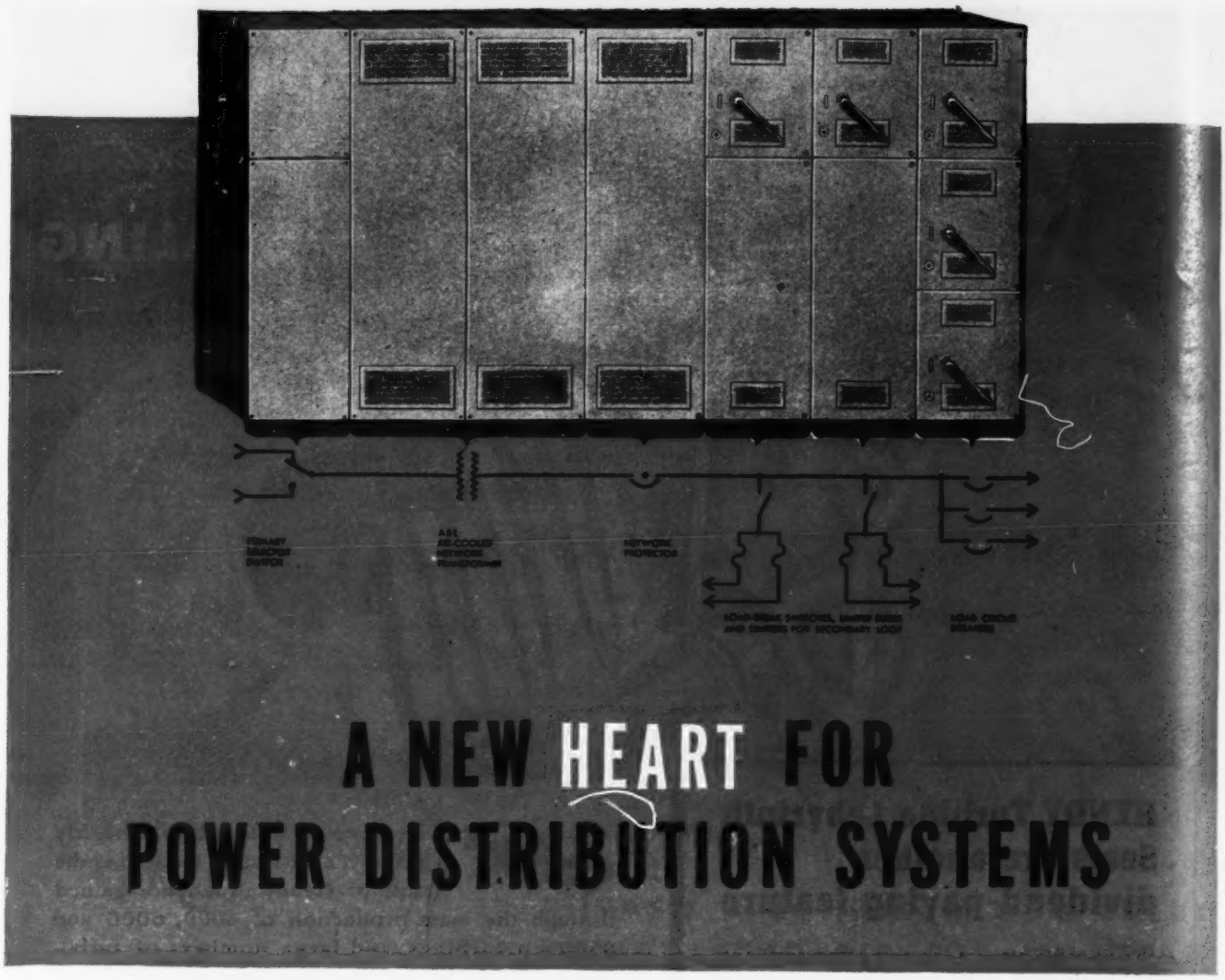
Hendy turbines are available as separate power units for marine or industrial applications, or, as complete turbo-generating plants in a wide range of sizes.

Submit your power problem to any Hendy office. They will gladly help in its solution.

JOSHUA HENDY IRON WORKS
ESTABLISHED 1856
SUNNYVALE, CALIFORNIA

Branch Offices: WASHINGTON · BUFFALO · CHICAGO · CINCINNATI · CLEVELAND · NEW YORK · LOS ANGELES · DETROIT · PHILADELPHIA · PITTSBURGH · SAN FRANCISCO · BOSTON

TURBO-GENERATORS · REDUCTION GEARS · STEAM TURBINES · DIESEL ENGINES



A NEW HEART FOR POWER DISTRIBUTION SYSTEMS

ordered—installed—operated as a unit

Here is a new heart for power distribution systems —the *Westinghouse Network Unit.* It saves time in ordering, installation and operation. It eliminates piecemeal assembly on the job! It can be installed anywhere indoors without a vault—because it is completely air-cooled. It can be installed in the immediate vicinity of working personnel with complete safety, or it can be placed overhead to save valuable floor space.

This flexibility results in substantial savings in materials and labor, and in service interruptions, with consequent production losses. It permits location of the Network Unit at or near the centers of load.

The Westinghouse Air-cooled Network Unit is only one item of the complete equipment Westinghouse can supply. Others are: control centers, power centers, switches, breakers, capacitors, protective devices, switchgear—in fact, all the equipment needed for any power distribution system. By ordering from *one* supplier, you place responsibility in *one* place . . . save time in ordering, installation and co-ordination for operation.

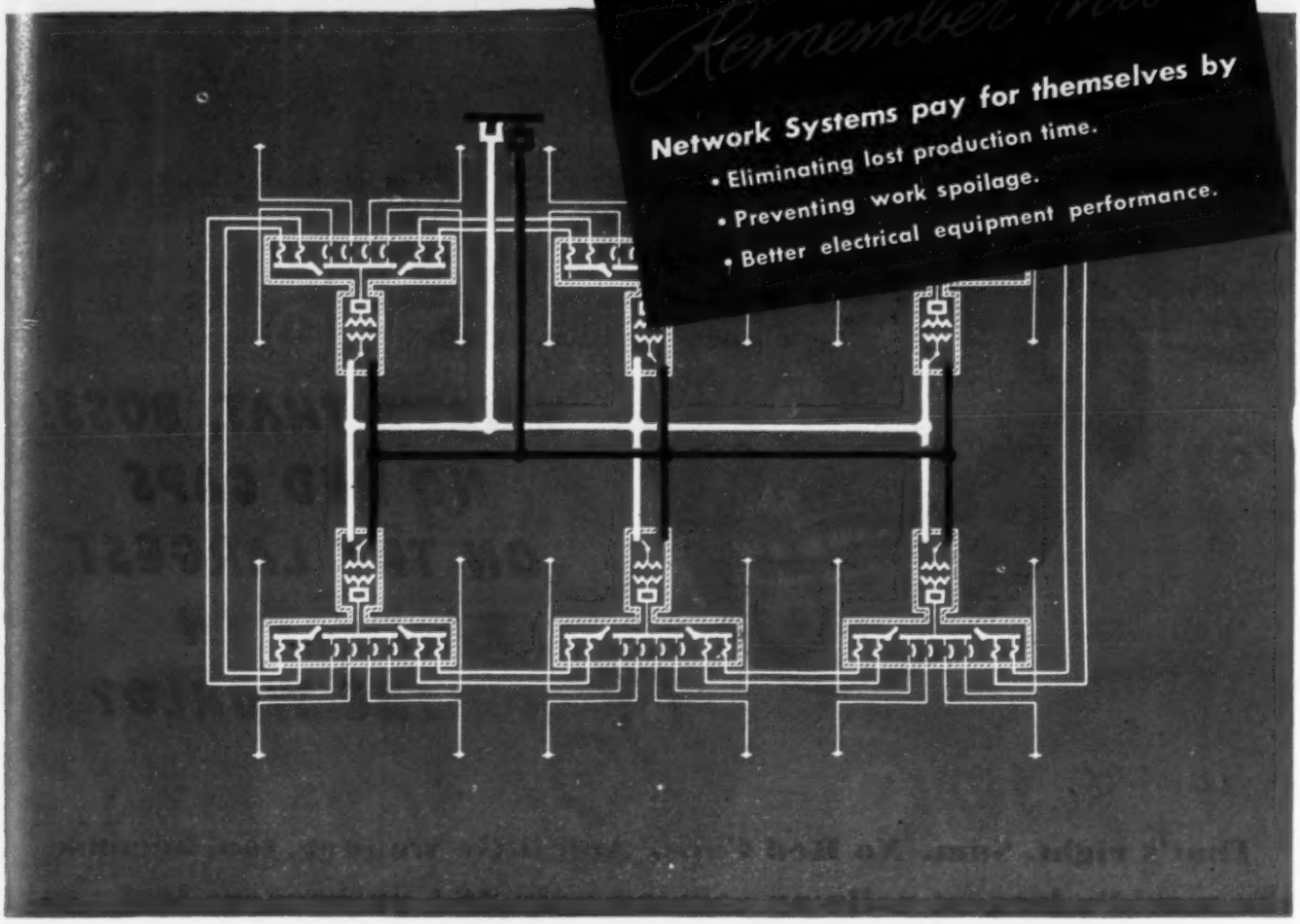
Complete specifications on all equipment are available to help you PLAN NOW for postwar construction. Phone your Westinghouse Office, or write Westinghouse Electric & Mfg. Co., P. O. Box 868, Pittsburgh 30, Pennsylvania. J-94642A

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

INDUSTRIAL

FOR YOUR NEW ELECTRICAL DISTRIBUTION SYSTEM


Remember This—
Network Systems pay for themselves by
• Eliminating lost production time.
• Preventing work spoilage.
• Better electrical equipment performance.

Since the first installation of Westinghouse industrial plant network systems (four years ago), we have been receiving comments like these:

- "because it assures uninterrupted service, we figure our network system has completely paid for itself by eliminating loss of production time caused by electric power interruptions."
- "light flicker has been entirely eliminated . . . improving working conditions and efficiency."
- "production has been increased because our motors are now getting the *right* voltage at *all* times . . . no longer any motor burnouts caused by undervoltage."
- "addition of new electrical facilities for critical work production was made in 50% less time . . . without disturbing any of the previous facilities."

We sincerely believe that wherever the highest degree of flexibility —reliability—and voltage regulation are "musts", the Westinghouse network system is best suited for tomorrow's profitable production of peacetime goods.

However, Westinghouse supplies all types of electrical distribution systems, and will recommend the one best suited to your needs.

Call your Westinghouse representative today for advice and *practical* help in laying out your postwar distribution system. It pays to blueprint now for tomorrow's needs.

PLANT DISTRIBUTION SYSTEMS

WHAT'S THAT, BOSS! NO RED CAPS ON THE LARGEST RAILWAY IN THE WORLD?

That's right, Sam. No Red Caps. And little wonder, too, because the world's largest railway carried only 264 passengers last year!

Not one of them carried satchels or suit-cases. Those 264 passengers, you see, were *ships* traveling up and down Commercial Iron Works' own railway... *the world's largest sidehaul marine railway.* Hardly the place for red caps and landlubbers, running smack into the river the way this railroad does! ¶ Built primarily as a ship repair installation, this unique railway is equipped to pick injured ships out of the water and carry them ashore for repairs or conversion. Vessels are shunted onto any one of several transfer tracks, leaving the lifting mechanism free for the moving of additional ships. Five ships can be handled simultaneously on the railway area's 14½ acres of trackage. ¶ Commercial Iron Works' entire yard, stretching 4400 feet along the Portland waterfront, is indeed capable of taking on big ships... *big jobs!* Fitting symbol of these eminent potentialities is the world's largest sidehaul marine railway, operated by the world's best brains and hands: those of free Americans.

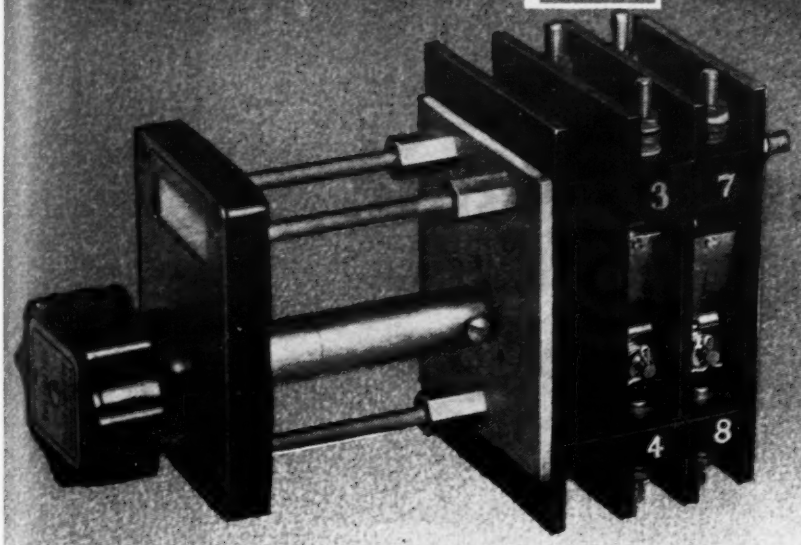
Commercial Iron Works

PORTLAND, OREGON

ENGINEERS • MACHINISTS • FOUNDERS • SHIPBUILDING • MARINE REPAIRS • DRYDOCKING

1 + 1 = 3

INSTRUMENTS



Roller-Smith Type R-2 Rotary Instrument Switches on your switchboard panels will multiply the usefulness of instruments by making one do the work of several. For example, one ammeter connected through an ammeter switch can be used to read each phase of a 3-phase circuit, thereby saving two ammeters. Or one voltmeter can be used to measure as many as seven different circuits simply by turning the rotary switch.

Type R-2 Rotary Switches have bodies of unit construction with molded Bakelite for contact housings. Contact arms are silver plated brass, and contact points are silver buttons, riveted to the arms. Compression springs carry no current and assure ample contact pressure. Dust and dirt will not affect operation of the switch because contacts operate in a vertical position.

Standard Type R-2 Rotary Switches are available in 88 combinations. Special switches can be readily built to your requirements. Bulletin 7140, virtually a textbook on instrument and control switches, includes complete technical data for all Type R-2 Rotary Switches—Instrument, Control, Auxiliary and Transfer—with diagrams of connections, switch developments and many application recommendations. Send for your copy today.

ROLLER SMITH

Sales Representatives In all Principal Cities

ROLLER-SMITH BETHLEHEM, PENNA.

Canadian Plant: ROLLER-SMITH MARSLAND, LTD., Kitchener, Ontario

STANDARD AND PRECISION ELECTRICAL INSTRUMENTS • AIRCRAFT INSTRUMENTS • SWITCHGEAR • AIR AND OIL CIRCUIT BREAKERS • ROTARY SWITCHES • RELAYS • PRECISION BALANCES

Collyer

VARNISHED CAMBRIC

THE CABLE WITH A PLUS

When you buy wire and cable, it's the *EXTRA* margin of quality that pays off in *EXTRA* service and reliability. Here at Collyer our business is founded on years of delivering this extra quality.—It's the PLUS that makes Collyer Varnished Cambric Wires and Cables leaders in the field.

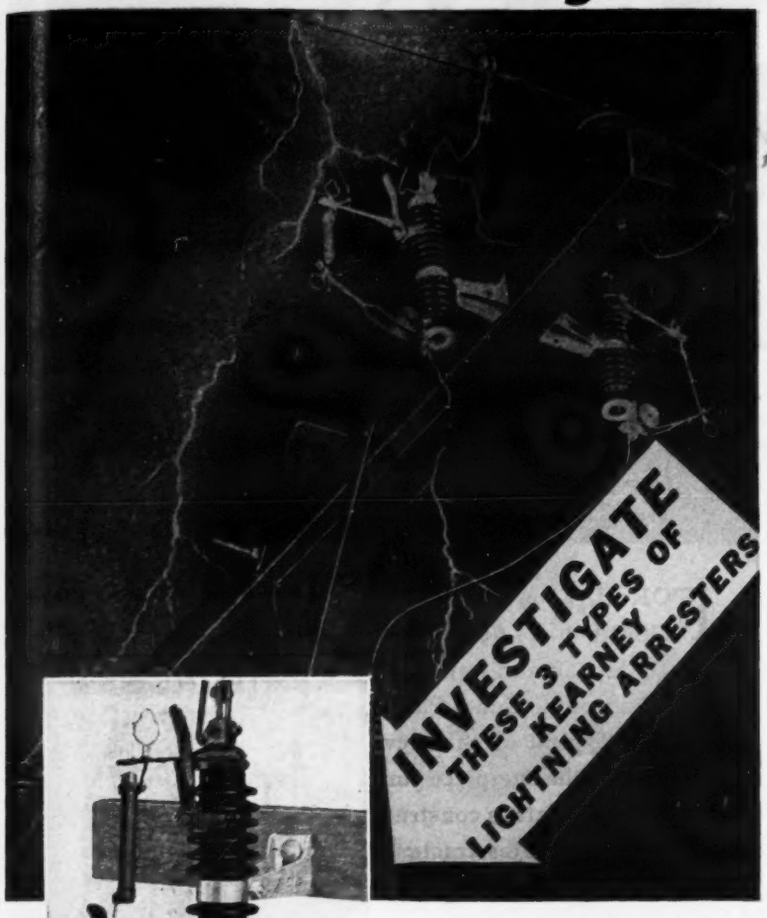
Produced by modern machinery and experienced workmen, Collyer Varnished Cambric Wires and Cables have high dielectric strength and exceptionally long life even under difficult operating conditions. Let us know your requirements.

Collyer

INSULATED WIRE COMPANY

257 ROOSEVELT AVE., PAWTUCKET, R. I.

for LOW COST Lightning PROTECTION

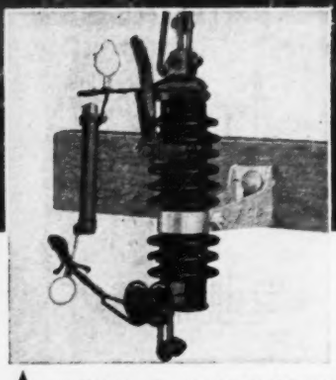


Install

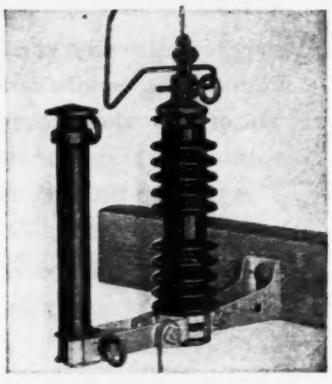
KEARNEY LIGHTNING ARRESTERS

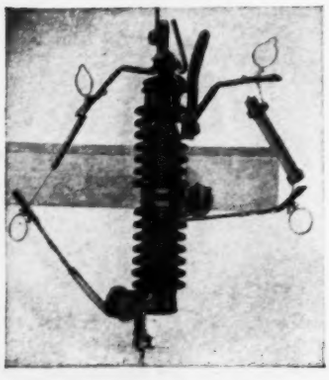
The economy and dependability of the expulsion tube principle of lightning protection has been applied by Kearney engineers to arresters designed for use under various field conditions. Design features common to all Kearney Arresters include: arc expulsion cartridges readily removable for inspection or replacement; adjustable air gaps, and mountings for poles, crossarms, or transformers.

Kearney Lightning Arresters offer protection to line apparatus by providing a direct, low-resistance ground path for the discharge of lightning or other high-voltage surges. At the same time the Kearney expulsion tube breaks the arc of the power follow current before it can damage equipment or interrupt service.



↑ **TYPE T ARRESTER**—Utilizes fast, arc-extinguishing horn fibre. Expulsion tubes have weather-resistant vitrified tubular shields. External air gap assures continuity of service and keeps potential off gap during normal operation.





↑ **THE TYPE P**—The Kearney Type P Lightning Arrester has an impulse rating of 41,000 amperes and a follow current interrupting rating of 3000 amperes. A long insulator leakage path assures maximum protection. In the event of an abnormal discharge an economical easily replaced cartridge is the only part subject to damage, which is visible at a glance.

← *Combination* **TYPE T TRIP-O-LINK ARRESTER**—This unit combines the Kearney Type T Arrester and the efficient Trip-O-Link Fuse Switch into a single assembly. Eliminates the need of an extra mounting to pole or crossarm and only one line lead is required—results in greater economy and facilitates hot line work on any pole.

JAMES R. KEARNEY CORPORATION

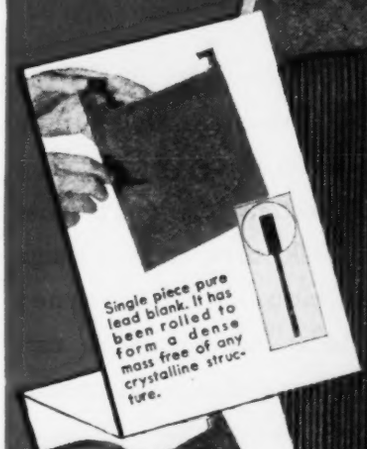
DESIGNERS **UTILITY EQUIPMENT** *MANUFACTURERS*

4224-42 CLAYTON AVE., ST. LOUIS 10, MO. • *Canadian Plant:* LEASIDE, ONTARIO, CANADA

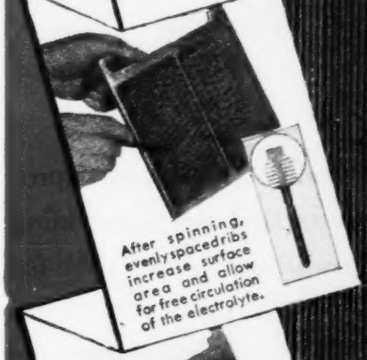
GOULD PLANTÉ

Half a century of development

THE BATTERY PICKED BY ENGINEERS



Single piece pure lead blank. It has been rolled to form a dense mass free of any crystalline structure.

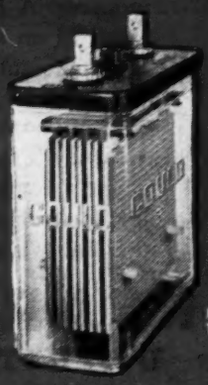


After spinning, evenly spaced ribs increase surface area and allow for free circulation of the electrolyte.

Chemically pure processing coats ribs with a dense film of active material made from the plate itself.

FOR HALF A CENTURY Gould has been constantly testing and improving the design of the Gould Plante battery. Typical of this development is the one-piece pure lead positive plate, a construction that eliminates fractures and strains due to dissimilar metals.

Pure lead also gives the Gould Plante its inherent characteristic of maintaining a constant volume of active material. This assures the user of flat, even voltage, sustained capacity and exceptionally long service life.



The Gould Plante is first choice for control and standby operations, and all stationary applications.

Write Dept. 1211 for Catalog 1000 on Gould Sealed-in-Glass Batteries for Stationary Applications.

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD

GOULD STORAGE BATTERY CORPORATION

Depew, N. Y. Factories: Atlanta • Chicago • Dallas • Depew • Leavenworth • Los Angeles • North Bergen • Rock Island • St. Paul • South City • Zanesville

When OVERHEAD goes *Underground*

Phantom view of socket and cone clamping element of the Mole.

MOLIMITER — gives Limiter protection to cables terminating at the Burndy Mole.

Assembly view of Mole. Insulating sleeves speed taping over terminal clamps.

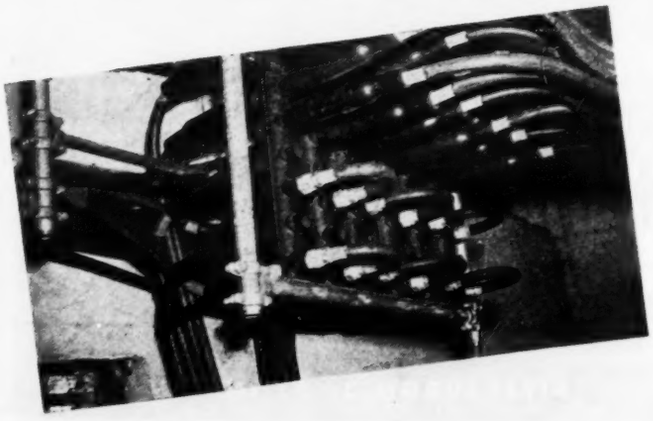
Rubber plugs stop off outlets not in use.

The Burndy MOLE

Provides economies — both Present and Future!

You will want to include the Burndy Mole* in your network plans. Thousands of these pre-insulated, multiple-tap connectors have been in use for years, under all kinds of operating conditions. Important features you will find in the Mole include:

- Maximum flexibility in both installation and service. Easy to rack.
- The number of feeders and taps may be increased or decreased with very little inconvenience. Rubber plugs stop off outlets not in use.
- Larger or smaller conductors may be easily interchanged.
- Mole outlets can be equipped with Molimiters for cable protection. See cut-away view.
- Moles are supplied with any number of outlets desired. Many variations available including Molestud Connectors for network protectors and transformers.



For complete details, send for Bulletin No. 6001. Burndy Engineering Company, Inc., 107-J Bruckner Blvd., New York 54, New York.

Headquarters for CONNECTORS

Burndy

* Registered U.S. Patent Office. Pat. No. 2,087,384.

FROM THE COMPLETE LINE OF OLIVER POLE LINE MATERIALS

Oliver SPECIALIZED CLAMPS

CABLE SUSPENSION CLAMPS

Made in two sizes as shown. Special sections of open hearth steel are used, 1-11/16 in. wide and 3/8 in. thick. Rolled to shape to grip the messenger strand firmly. Hot galvanized.

No. 5061

No. 5063

GRADE CLAMPS

Oliver Grade Clamps are designed for use where long spans or down grades have a tendency to cause the cable to creep. Four sizes, for cables of 1 3/8 to 2 7/8 inches diameter and messenger cables of 5/16 to 1/2 inches. Smooth surfaces prevent damage to cables.

No. 5105

BONDING CLAMPS

For use where guys are a part of the grounding system, Oliver Bonding Clamps provide a dependable mechanical and electrical pressure contact between guy strand and anchor rod. Lock washer prevents loosening; firm grip eliminates abrasive wear of strand.

No. 9123

OLIVER
IRON AND STEEL
CORPORATION

SOUTH TENTH AND MURIEL STREETS · PITTSBURGH 3, PENNSYLVANIA

Hotpoint-Edison Pre-Sells Your Customers in 14 Trade Magazines!

SPEARHEADING the campaign to cushion "Load Drop" for you is Hotpoint-Edison's advertising program for commercial electric cooking. Advertisements like the one shown are stimulating the trend to electric cooking in publications reaching hospitals, schools, restaurants, hotels, etc.

★ ★ ★

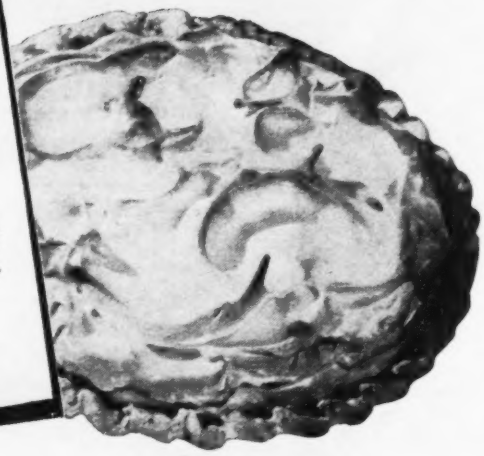
The civilian field has been consistently sold on the broad benefits of commercial electric cooking. It is receptive to a postwar change that will take up your slack when "War-par" electric power consumption drops off abruptly.

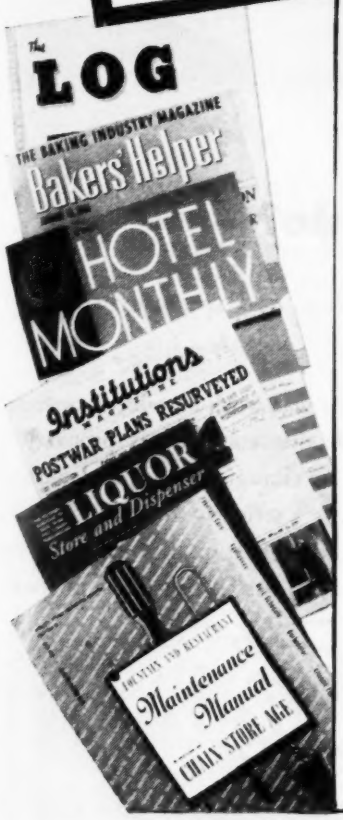
★ ★ ★

Follow up Hotpoint's hard-hitting campaign that advertises the efficiency, economy and all-around excellence of commercial electric cooking for your "Load Drop" solution.

Edison General Electric Appliance Co., Inc.,
5618 West Taylor St., Chicago 44, Ill.

Hotpoint Dependability Assured by 40 Years Experience!





..when Hotpoint-Edison is on the job!

SATISFIED customers bring in the extra sales that spell *PROFIT!* The eye-appeal of delicious food will start them buying; the taste-appeal will bring them back for more. Hotpoint-Edison offers a proven method to assure approval of your bakery products.

Why Hotpoint-Edison Electric Bake Ovens Bring Results

● Your customers can rely on uniform excellence in your products. The accurate automatic top and bottom heat control in the Hotpoint-Edison Electric Bake Oven guarantees you'll never lose patronage because of under-cooked or over-cooked foods. Each deck has a separate heat control . . . you can bake products requiring different temperatures at the same time in separate compartments. This compact AD-A-DECK construction also saves space. Capacity can be increased without sacrificing floor space.

Employee Conditions Bettered

● Heat is kept where it belongs . . . assuring greater coolness. Ventilation is improved . . . no fumes, and no flame. No need for fans, flues or expensive air-conditioning. Clean . . . no combustion dirt, dust, smoke or ashes. For greater profits, customer satisfaction and employee comfort . . . Bake the Hotpoint-Edison Electric way!

Edison General Electric Appliance Co., Inc.
5685 West Taylor Street, Chicago 44, Ill.

● Government regulations now permit manufacture of equipment for essential civilian use. If your present equipment is inadequate or beyond repair, consult your local power company or write to us.

HOTPOINT REGIONAL SALES OFFICES. EASTERN: 570 Lexington Avenue, New York City 22, Plaza 3-9333. SOUTHERN: 304 Red Rock Building, Atlanta 3, Walnut 2959. CENTRAL: 1456 Merchandise Mart, Chicago 54, Superior 1174. WESTERN: Western Merchandise Mart, 1355 Market Street, San Francisco 3, Underhill 2727.

OLDEST AND LARGEST MANUFACTURERS OF ELECTRIC COOKING EQUIPMENT

HOTPOINT EDISON

COMMERCIAL ELECTRIC COOKING EQUIPMENT

RANGES • BAKE OVENS • ROASTING OVENS • DEEP FAT FRY KETTLES • BROILERS • GRIDDLES

WHAT HAS OTIS ELEVATOR COMPANY BEEN DOING?

...and what are they PREPARED to do?

The factories of the Otis Elevator Company have been devoted one hundred per cent to the war effort. That's not unique. That's the pattern of American industry.

however...

In addition to our large scale production of a great variety of highly precise mechanisms of war for the Army, Navy, and the Air Corps, we have continued to produce elevators. We have manufactured freight as well as passenger elevators for hospitals, ordnance depots, naval warehouses, and other priority installations.

this means...

Although our facilities, organization, and resources have enlisted for the duration and have gone all out for war production *as a matter of actual fact we have never been out of the business of manufacturing, installing, and servicing elevators.*

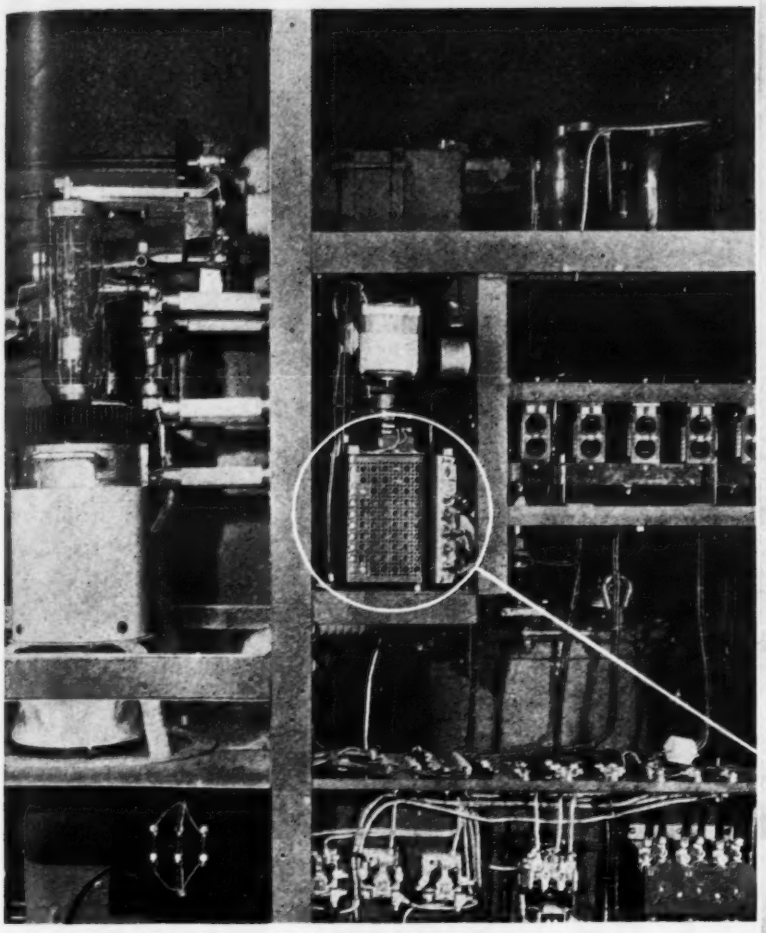
and so...

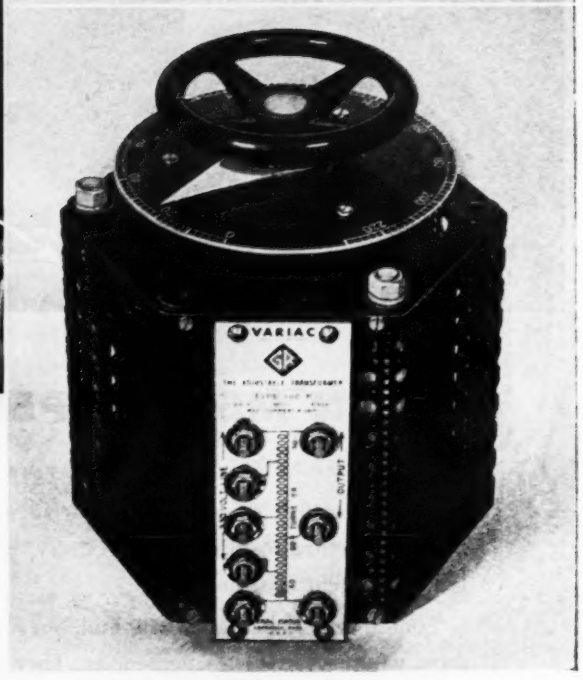
As our war work is reduced or terminated, this company is prepared – with no change in pace, and without missing a stride – to resume furnishing the highest quality elevators and escalators for all peacetime purposes.

Otis ELEVATOR COMPANY

OFFICES IN ALL PRINCIPAL CITIES

PLASTIC HEATING





Photos Courtesy Illinois Tool Works

IN THIS 20-kw high-frequency Illitron induction heating equipment the Illinois Tool Works use three VARIACS: one in each of the two oscillator filament transformer circuits, driven by a reversible motor which is interconnected with relays with both high tension and filament supplies so that voltage cannot be applied to the filaments unless the voltage starts from zero; a third VARIAC is used to adjust the d-c grid voltage on the tubes.

Illitrons, as do thousands of other commercial applications, make use of VARIACS because of their advanced mechanical design, low no-load losses and long and dependable life.

If you are interested in any type of s-m-o-o-th a-c voltage control, investigate VARIACS.

WRITE FOR BULLETIN 938

GENERAL RADIO COMPANY

Cambridge 39, Massachusetts
New York 6 Chicago 5
Los Angeles 38

WHEN MERCY SPEEDS ON WHIRLING WINGS

Flood, storm, forest fire or a major accident often maroons victims in inaccessible country, far from relief so urgent in saving lives.

Tomorrow's helicopters will find one of their most vital uses in such emergencies. They can go straight up or down, and fly swiftly forward. If it were necessary, they could even *"stand still in the air"*, only a few inches above ground, to unload relief cargo, or take aboard ill or injured persons.

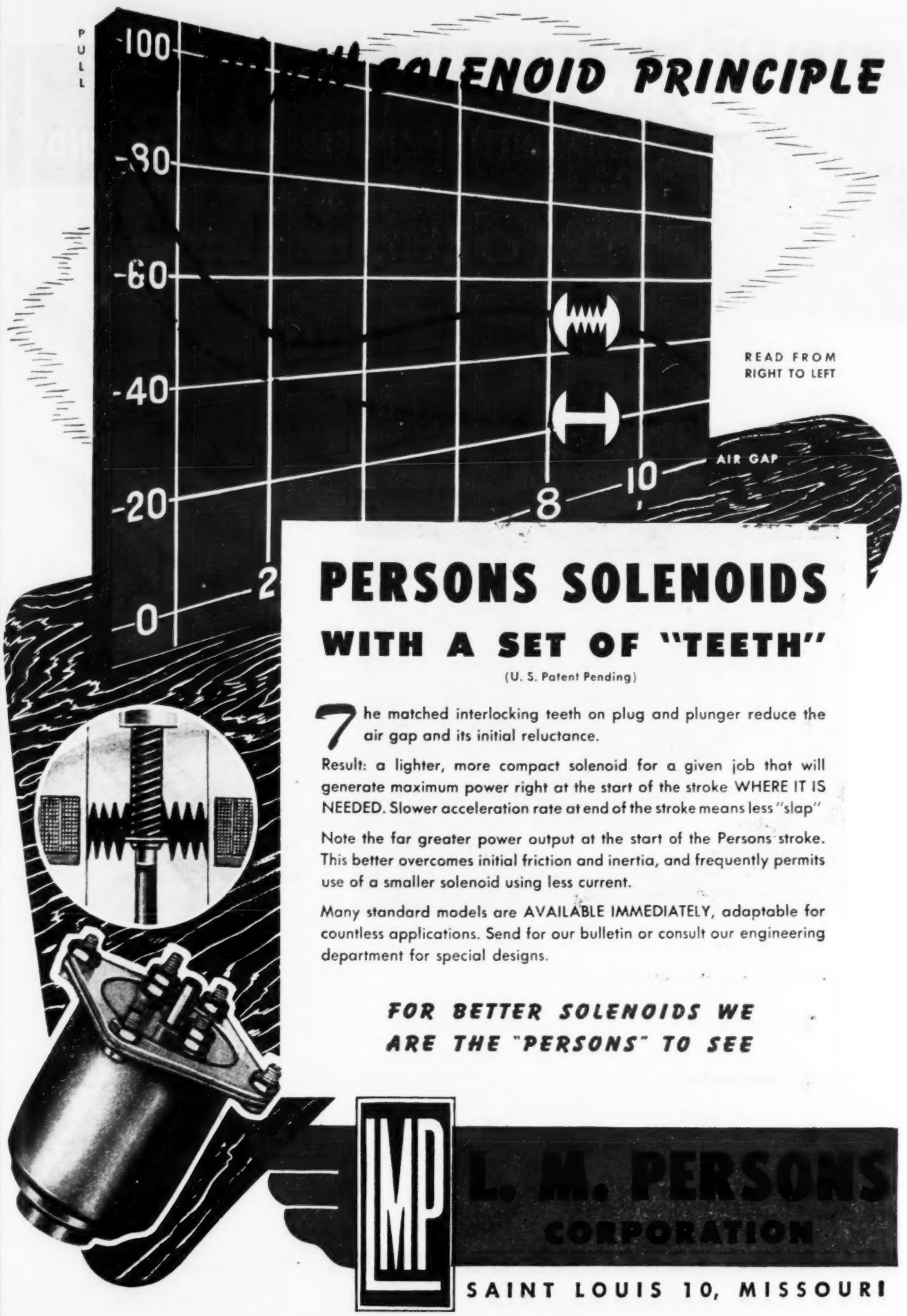
Under war stimulus, with Government encouragement, great strides have been made in the development of helicopters. They can serve a wide range of activities, from crop-dusting to exploration in regions where no other craft can land or take off. Kellett engineers have had an important part in this evolution. They are preparing now for the time when helicopters will perform many of the challenging tasks of peace, the world over.

THIS FREE BOOKLET TELLS YOU

If you wish to have more information about this new empire of "flight without wings," just write for "Answering Some Helicopter Questions". Kellett Aircraft Corporation, Dept. E, Upper Darby (Philadelphia), Pa.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY



SOLENOID PRINCIPLE

PERSONS SOLENOIDS

WITH A SET OF "TEETH"

(U. S. Patent Pending)

The matched interlocking teeth on plug and plunger reduce the air gap and its initial reluctance.

Result: a lighter, more compact solenoid for a given job that will generate maximum power right at the start of the stroke WHERE IT IS NEEDED. Slower acceleration rate at end of the stroke means less "slap"

Note the far greater power output at the start of the Persons stroke. This better overcomes initial friction and inertia, and frequently permits use of a smaller solenoid using less current.

Many standard models are AVAILABLE IMMEDIATELY, adaptable for countless applications. Send for our bulletin or consult our engineering department for special designs.

FOR BETTER SOLENOIDS WE ARE THE "PERSONS" TO SEE

LMP

L. M. PERSONS CORPORATION

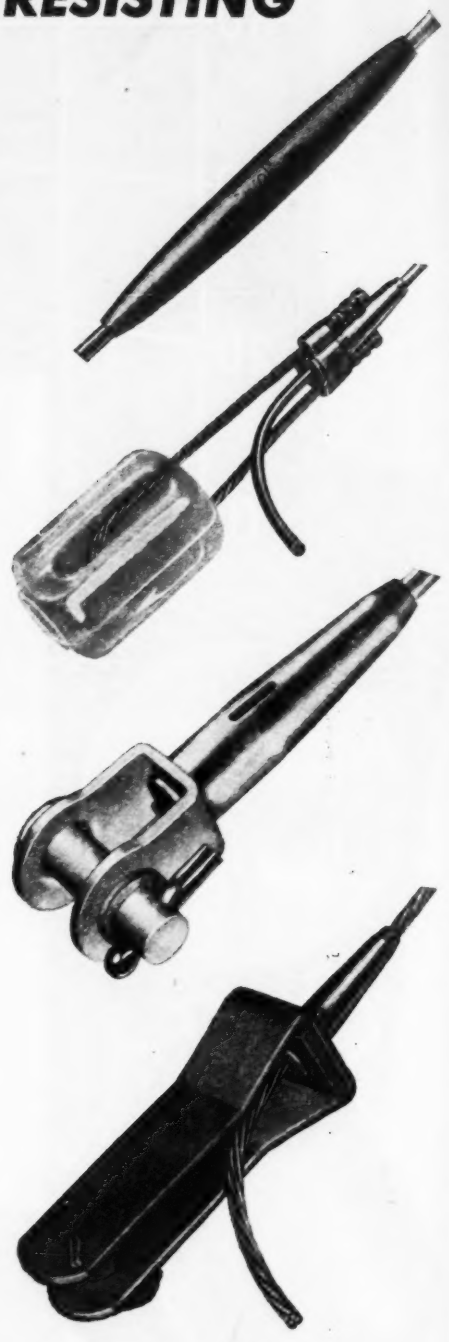
SAINT LOUIS 10, MISSOURI

3RD TEST OF A SERIES

Reliable proves that STRAIGHTLINE SPLICES AND DEAD ENDS ARE CORROSION RESISTING

Reliable's policy of systematic testing also includes a relentless battle against the common enemy "corrosion". Specimens of Reliable Connectors, Splices and Deadends are constantly subjected to salt spray and acid vapor tests and checked for conductivity. This conductivity is excellent in tests equalling more than a lifetime of atmospheric corrosion. Note the actual test specimens below.

Above photograph shows actual corrosion test and equipment devised by Reliable engineers to best study this important test requirement



Seeing is believing—watch for other test proof

1. Gripping Test
2. Vibration Test
3. Corrosion Test
4. Conductivity Test

RELIABLE ELECTRIC COMPANY, CHICAGO

OVER 35 YEARS SERVICE TO THE UTILITIES

Preferred for line construction and maintenance trucks, the FWD Model HST embodies the accumulated experience of 35 years of FWD leadership in four-wheel-drive trucks.

HOW FWDs ARE

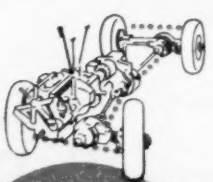
Easing the Manpower Shortage

FOR UTILITIES

Despite wartime handicaps . . . manpower shortages, over-worked equipment and other limitations . . . utilities are meeting unprecedented emergency demands. FWD trucks are helping more than 150 utility companies maintain their traditional reputation for unfailing service.

FWDs add to the work range and capacity of available crews and equipment. On or off the pavement, cross-country or on main highways, FWDs get through to location. The extra dependability — the full power and traction of four driving wheels — the rugged construction where ruggedness counts — the ability to haul longer for less in gas, oil, tires and maintenance — have won for FWDs preferred ranking as tough, unusually able line-construction and maintenance trucks.

FOR ESSENTIAL INDUSTRIES, a limited number of FWDs will be available this year. Phone, wire or write us, or see the nearest authorized FWD dealer.



THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin
Canadian Factory: KITCHENER, ONTARIO

This FWD Model HS with body built expressly for utility service, is helping Hydro Electric Power Commission, Toronto, Canada, to solve manpower problems.

FWD TRUCKS

THE ORIGINAL EXCLUSIVE BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS

With this 5-man cab-over-engine FWD Model HST, the Oconomowoc (Wisconsin) Water & Light Department is maintaining service regardless of manpower handicaps.

You Know Mortimer . . .

1 Don't underestimate Mortimer Guest,
Never believe he's a moron.
He waits in line when a room is his quest
Only because there's a war on.

2 Watch for the day when the Vict'ry bells chime,
Duck when his patience he loses.
Then is when Mort will have *him*self a time —
Then he will lodge where he chooses.

3 Comfort he'll get, or he simply won't park.
These he'll insist on directly:—
Room, bed and board always up to the mark —
Air that's conditioned correctly.

Air Conditioning will be a postwar essential to almost every conceivable business. Executives everywhere — your commercial and industrial consumers — are hearing about *correct* air conditioning through advertisements like this.

They're learning to depend upon Westinghouse for correct air conditioning . . . the scientifically-engineered blending of correct temperature, humidity, circulation, ventilation and air cleanliness.

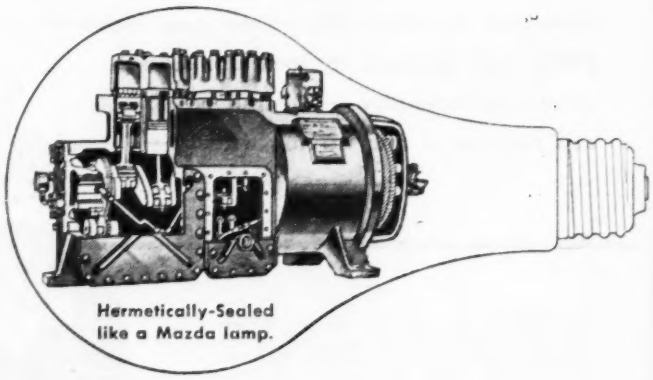
Your commercial men will find the Westinghouse booklet "How to Plan Correct Air Conditioning," a valuable aid in showing consumers how to get what they need for their complete satisfaction. We'll be glad to supply it in quantity. Phone your nearest Westinghouse office or write Westinghouse, 150 Pacific Avenue, Jersey City 4, N. J.

THE SERVICE-PROVED HERMETICALLY-SEALED COMPRESSOR

These Westinghouse economy-satisfaction advantages have been proved by years of service in thousands of installations:—

No Shaft Seals. During wartime refrigerant shortages, few Westinghouse systems were ever "down." Why? Because seal leaks are the cause of a large percentage of all system failures.

Few Parts to Wear . . . Direct-Drive Efficiency . . . Space-Saving Refrigerant-Cooled Motor.



Hermetically-Sealed like a Mazda lamp.

Westinghouse CORRECT Air Conditioning

PLANTS IN 25 CITIES . . OFFICES EVERYWHERE

Westinghouse Presents *John Charles Thomas* • Sunday, 2:30 E.W.T., N.B.C.

Another FIRST for *Federal* Selenium Rectifiers

FEDERAL'S INVERTER FAILURE RELAY

In a B-29 high over Tokyo . . . or a Clipper winging across the Atlantic—an instrument panel lamp flashes timely warning of a-c power failure.

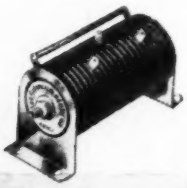
This is the job done by Federal's Inverter Failure Relay . . . always on the alert, providing a constant check on inverter operation. Highly sensitive, this compact unit responds to line variations as low as *one* volt.

Here the specific need was for an accurate relay to operate on an a-c line. Federal engineers supplied the answer with a Federal Selenium Rectifier and a sensitive d-c relay.

This is another example of Federal engineering ingenuity, the kind of ingenuity you need to solve your rectification problems—particularly in the new higher frequency aircraft a-c power systems.

Look to Federal for the best in Selenium Rectifier equipment, *first in the field and standard for industry.*

Federal's Inverter Failure Relay, shown actual size, operates on 115-volts, 400 cycles a-c, the relay contacts carrying approximately one ampere at 28 volts.



FEDERAL TELEPHONE & RADIO — FTR

Federal Telephone and Radio Corporation

Newark 1, New Jersey

TOAST EVERY MORNING

Toast is traditionally a part of America's breakfast. This has been so since about 40 years ago, when electric toasters were first introduced through the discovery of Chromel for heating elements. With Chromel, for the first time, came not only good toasters but good irons, and later all the other appliances. You see, Chromel was the first durable heating element because it withstood the relentless oxidizing action of the air. You can rely on Chromel. It is usefully described in Catalog-M, which we'll gladly send. Ask for it.

RESISTIVITY @ 68°F

	WIRE (C. M. Ft.)	RIBBON (Sq. M. Ft.)
Chromel-A	650 Ohms	510 Ohms
Chromel-C	675 Ohms	530 Ohms
Chromel-D	600 Ohms	471 Ohms
Copel	294 Ohms	231 Ohms

Chromel* NICKEL CHROMIUM
HOSKINS CHROMEL ELECTRICAL HEATING ELEMENT WIRE

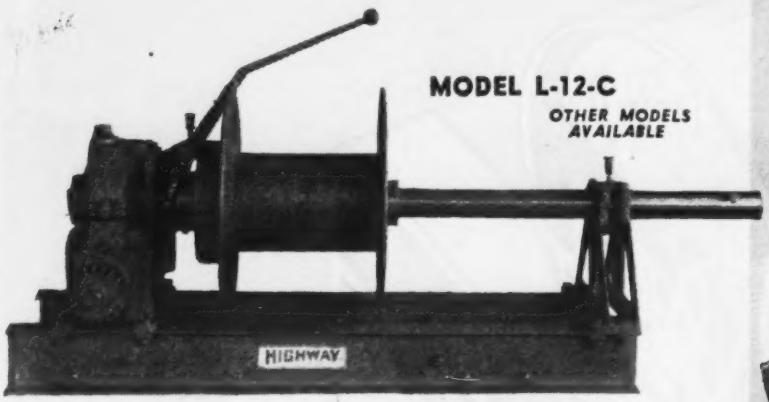
*Used as the heating element in millions of devices

HOSKINS MANUFACTURING COMPANY, DETROIT 8, MICHIGAN

SMALL • • COMPACT • • DURABLE • • •

HIGHWAY SINGLE DRUM *Winches*

for use with Middle Type Pole Derricks . . .



MODEL L-12-C
OTHER MODELS AVAILABLE

Automatic worm brake mounted on a worm shaft prevents overhauling.

The Highway Model L-12C winch is a small, free drum type, with ample strength and ruggedness to operate safely and efficiently on heavy-duty trucks, yet light enough in weight for use with 1½ and 2 ton chassis. The winch drum is made of electric cast steel and is mounted on a chrome nickel steel drum shaft. The worm wheel is of manganese bronze, carefully and accurately cut to operate smoothly with the nickel steel drop forged worm. A positive spline type clutch locks automatically in the engaged position and is controlled by a lever mounted either in the cab or on the winch.

SPECIFICATIONS

Length of Drum.....	12"
Diameter of Drum.....	8"
Diameter of Drum Flanges.....	19"
Cable Capacity (7/16" cable)	800'
Pulling Capacity	10,000 lbs.
Weight	470 lbs.

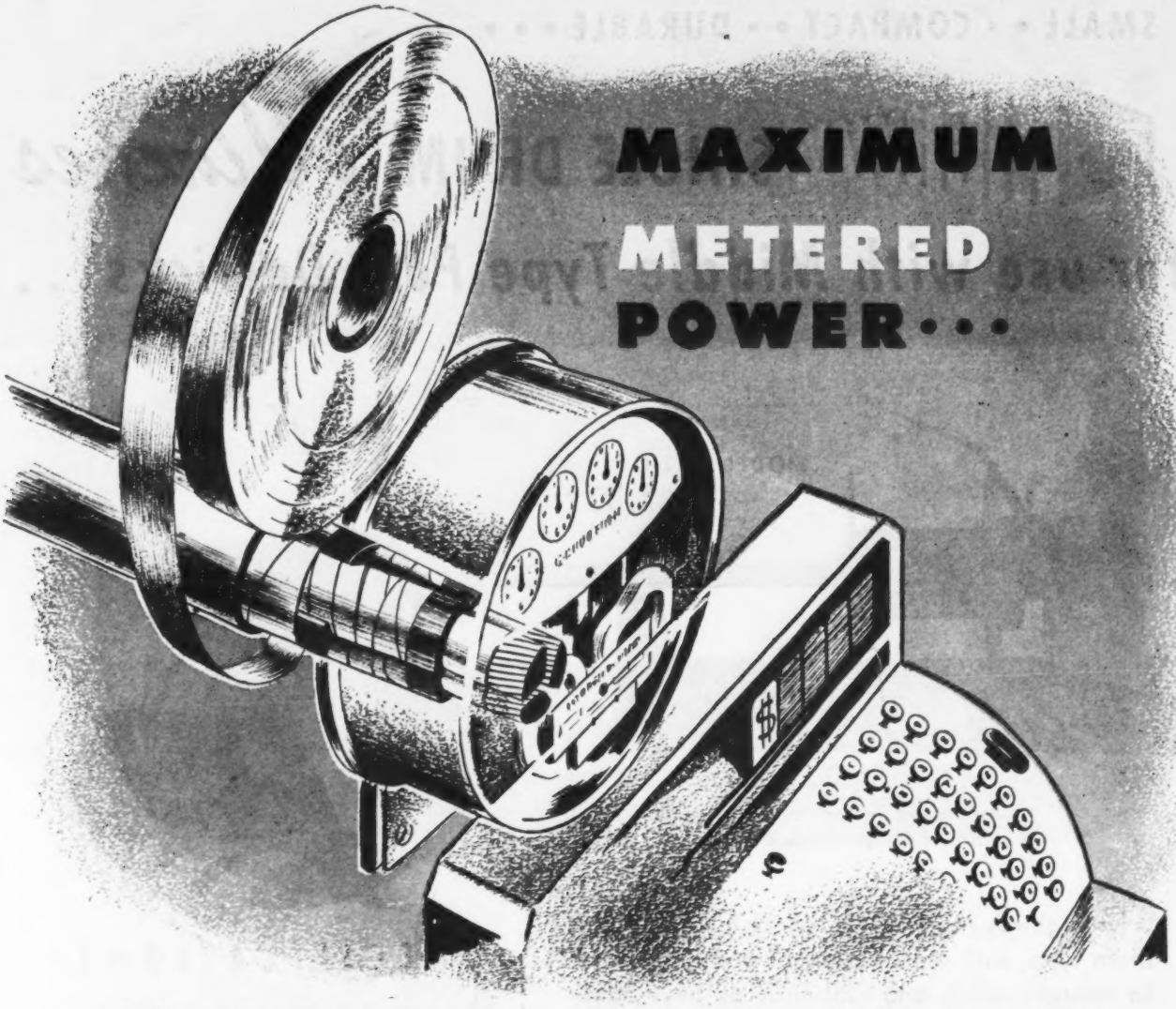
HIGHWAY TRAILER COMPANY

MANUFACTURERS OF

TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

General Offices

EDGERTON, WIS., U. S. A.



with Keller-Dorian Metallized Paper Tape

AT THE METER—*that's* where maximum power pays off. And that's what you get, when power cables are wrapped with Keller-Dorian Metallized Paper Tape.

As an electrostatic shield between insulation and outer sheath, Keller-Dorian Metallized Paper Tape eliminates power leaks due to corona. As a barrier between conductor and oil-impregnated paper insulation, it shuts out destructive chemical reactions. That means more *delivered* power . . . longer, more efficient cable service.

To get greater breakdown values . . . higher dielectric strength . . . lower power factor loss . . . reduced ionization . . . specify cables safeguarded with Keller-Dorian Metallized Paper Tape.

Made in many standard types or to your specifications, this protection is offered in cables made by these manufacturers:

General Cable Corporation

General Electric Corporation

Okonite-Callender Cable Company

Simplex Wire & Cable Company

U.S. Rubber Company

KELLER-DORIAN

CORPORATION

EMPIRE STATE BUILDING, NEW YORK 1, N.Y.

METALLIZED PAPER TAPES FOR ELECTRICAL WIRES AND CABLES

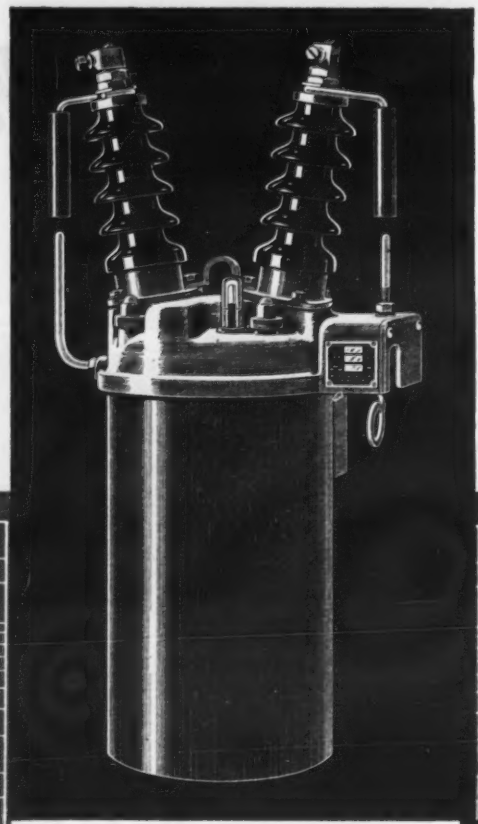
Type "H" KYLE Oil Circuit Reclosers AUTOMATICALLY keep MORE of your lines open MORE of the time

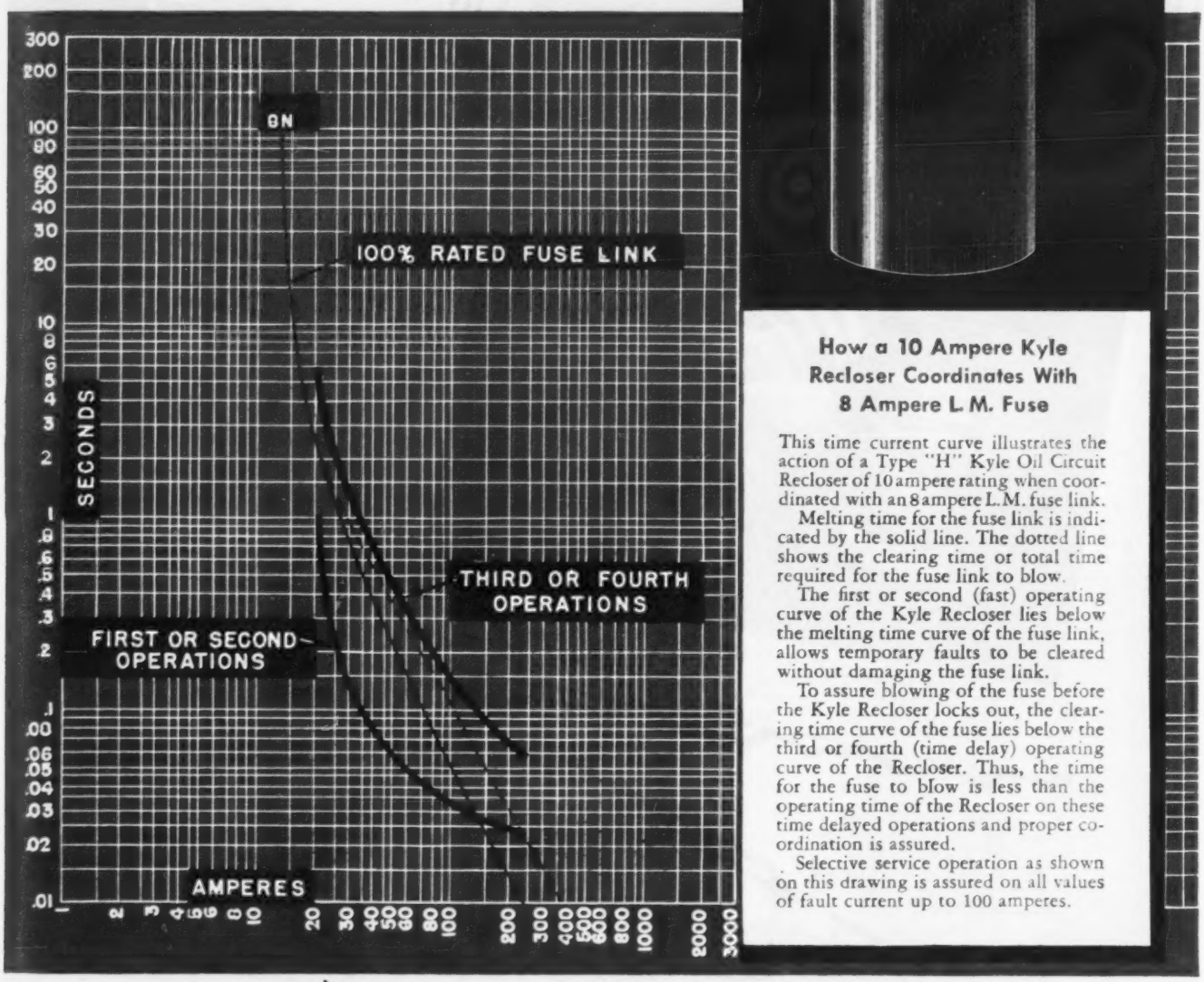
Use of Type "H" Kyle Automatic Oil Circuit Reclosers at strategic points gives greatest possible continuity of service.

Dual operating characteristics of Kyle Reclosers automatically act to protect the fuse links on all short-duration, temporary faults . . . save countless service trips. It is the result of the exclusive Kyle trouble-free hydraulic mechanism which gives:

1. **Fast Opening** on first and second operations . . . acts before the fuse can blow . . . automatically restores full service if the temporary fault is quickly cleared.

2. **Time Delay Opening** on third and fourth operations . . . permits the fuse to blow . . . isolates the short section of line that it protects.





How a 10 Ampere Kyle Recloser Coordinates With 8 Ampere L. M. Fuse

This time current curve illustrates the action of a Type "H" Kyle Oil Circuit Recloser of 10 ampere rating when coordinated with an 8 ampere L. M. fuse link.

Melting time for the fuse link is indicated by the solid line. The dotted line shows the clearing time or total time required for the fuse link to blow.

The first or second (fast) operating curve of the Kyle Recloser lies below the melting time curve of the fuse link, allows temporary faults to be cleared without damaging the fuse link.

To assure blowing of the fuse before the Kyle Recloser locks out, the clearing time curve of the fuse lies below the third or fourth (time delay) operating curve of the Recloser. Thus, the time for the fuse to blow is less than the operating time of the Recloser on these time delayed operations and proper coordination is assured.

Selective service operation as shown on this drawing is assured on all values of fault current up to 100 amperes.

Ask your Line Material representative for full information on Type "H" Kyle Automatic Oil Circuit Reclosers. He will be glad to supply time current charts and technical data on how Kyle Reclosers can be used to best advantage on your lines.

MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

KYLE Circuit Breakers are Designed and Manufactured for LINE MATERIAL COMPANY MILWAUKEE WISCONSIN

87 INSULATORS DAMAGED

Shots at Insulators Imperil Power to City War Plants

Thoughtless hunters taking target practice shots at insulators on the Central New York Power Corp. 33,000-volt feeder line in the southeastern section of Syracuse and the town of Onondaga have endangered the power supply to several war plants, to hospitals of the Syracuse Medical center, railroad yards and broadcasting stations.

Within 10 days 87 insulators, which come within the classification of critical war materials, were shattered. The line was saved because the damage took place principally during a period of good weather, which prevented the damaged insulators from flashing over. Prompt discovery of the wrecked insulators was another factor.

Moisture penetrating the broken insulators would have caused them to conduct current and short circuit the line, John Roy, superintendent of electric distribution for the power company, said yesterday.

Four youths arrested on malicious mischief charges by Trooper Frank Stritter of Lafayette were questioned by Assistant District Attorney Frank DelVecchio prior to arraignments before Justice Darwin N. Camp at Nedrow. Power company representatives were present when the youths admitted in the district attorney's office they wrecked 15 to 20 of the insulators.

The youths, Bernard O'Donnell, 16, of 135 Oakley dr., James Sauer, 16, of 1031 S. Geddes st., Irving French, 18, of 5446 S. Salina st., and James Vollmer, 16, of 121 Roswell ave., Nedrow, pleaded guilty and paid $10 fines. They said they did not understand the serious possibilities of breaking the insulators.

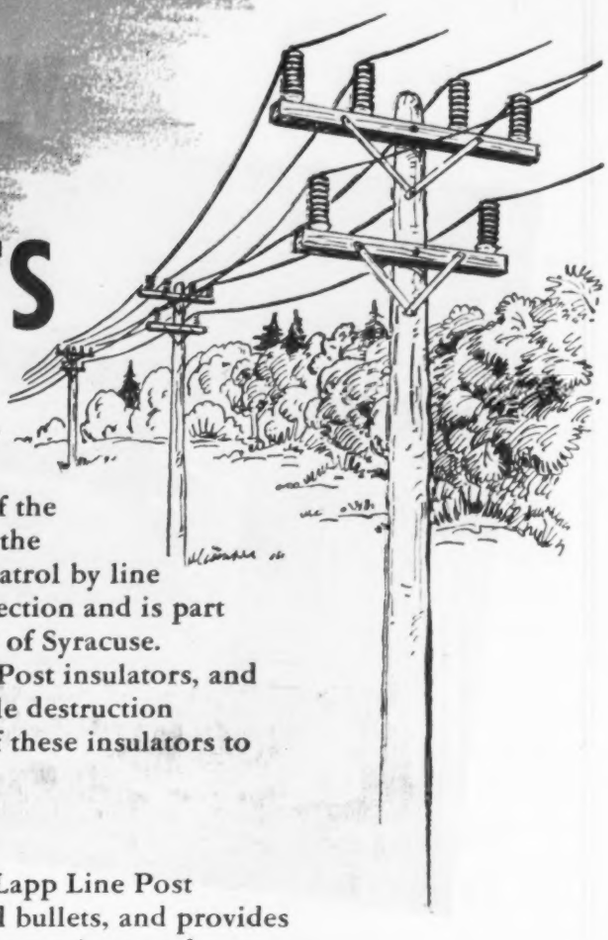
As a number of other persons have wrecked insulators in the same section, the investigation is being continued, and DelVecchio stressed yesterday the danger of serious interruption of the work of war plants.

The 33,000-volt line, Roy said yesterday, feeds out of the Teall ave. substation on the north, loops around the city on the east and south and back into the Solvay substation. Line patrolmen discovered the damage in the area on the hill east of the 5900 block of S. Salina st., Nedrow, Roy disclosed.

POWER LINE DAMAGED—Line Patrolmen Joseph Duda (left, above) and Frank Keppler examining some of the 87 insulators from a 33,000-volt power line damaged by high-power rifle bullets fired by hunters.

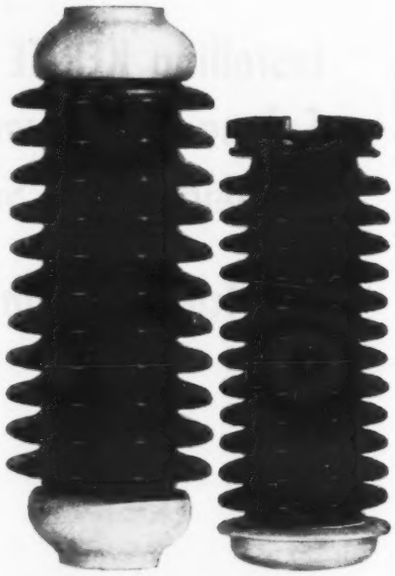
...NO OUTAGES...

...LAPP LINE POSTS



THE STORY: The amazing circumstance of 87 insulators badly damaged by high power rifle bullets . . . without any interruption of service . . . is the experience of the Central New York Power Corp. No line outage signalled the trouble, and the damage was discovered only on routine patrol by line maintenance men. The line is in a secluded and wooded section and is part of a double-circuit 33 Kv. feeder line which loops the city of Syracuse. The line was reinsulated in 1938 and 1939 on Lapp Line Post insulators, and the fact that no serious trouble resulted from this wholesale destruction is largely credited by maintenance officials to the ability of these insulators to withstand mechanical shock.

THE MORAL: The design conception of the Lapp Line Post insulator anticipated the possibility of attack by stones and bullets, and provides as nearly an indestructible unit as the industry has ever known. A rugged one-piece post body carries multiple short petticoats of such section thickness that under severe attack, the petticoats fracture off, leaving the body undamaged. Loss even of several petticoats does not substantially reduce leakage distance or flashover path. For duty in areas where such attack is likely, as well as for service under excessive dirt conditions, where radio interference is a problem—wherever the load must be carried dependably—Lapp Line Posts offer a *plus* in safety—and economy.



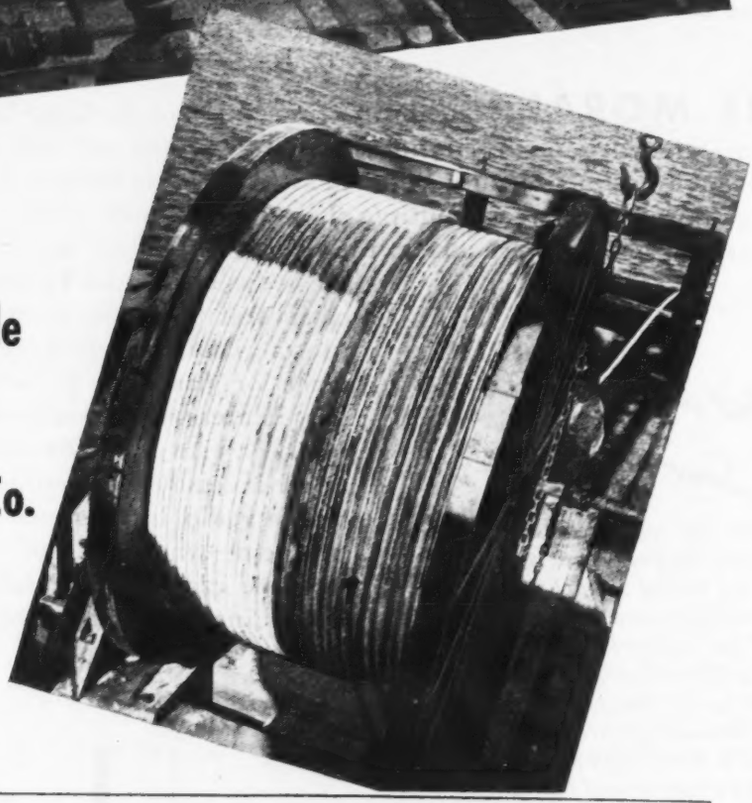
"Picked for Severe Duty"
"..Save Man-Hours"

"When we went into our line modernizing program seven years ago, we picked Lapp Line Posts as 'insulator-most-likely-to-succeed' for transmission line duty under difficult conditions. We've never had a line fail from Line Post insulator failure. And we've saved a lot of man-hours on insulator cleaning and insulator replacement. The shooting scrape of last fall, although not the first experience with this sort of trouble, only serves to emphasize the dependability of Lapp Posts."

. . . General Superintendent of Electrical Operations, Central New York Power Corp.

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.



Installing KERITE
Submarine Power Cable
in Long Island Sound

•

Westchester Lighting Co.

THE KERITE INSULATED WIRE & CABLE COMPANY INC

NEW YORK CHICAGO SAN FRANCISCO

Pioneers in Cable Engineering

Electrical World

MARCH 31, 1945

National Unity

A MAN NEW TO THE UTILITY BUSINESS but with more than 20 years' newspaper background, a man whose job it is to know how to appeal to the public and get people to act, wrote us last week as follows:

> "Please tell me why the privately owned electric industry fears a unified national organization, such as American Railroad Association? We have seen such efforts as the National Advertising Program conducted by some of the companies, which may be a step in the right direction, but it is not enough. Then again the Council of Electric Operating Companies is organized to do a war-time task. Isn't it about time for all privately owned companies, both large and small, to forget their past differences and get together on a national basis?"

It was strange that this letter should have come in but a day or two after the announcement from the Edison Electric Institute that the joint committee of the four industry groups had recommended that there should be no immediate consolidation into a single organization.

The industry has suffered for a long time for want of a central bureau, preferably in Washington, that would keep members of Congress, the press, the public and the industry's own employees constantly informed about the industry, its progress, its problems, its contributions to the public welfare. The members of the industry know this and, for the most part, want it. If enough companies can be found to finance a Washington Bureau, then still another association may be formed in an industry already crowded with associations. But much as it is needed, it would not be truly representative of the whole industry.

While there are still strong anti-private utility men in both houses of Congress, there are some who are just the opposite and in addition there is a large group that merely wants to be shown. Altogether, the general attitude is not nearly as hostile as it was a few years back.

Today we see the railroads getting consideration frequently because of their magnificent war job. Was it the fine war job that was responsible for this impression made on Congress and the public, or was it the fact that the unified railroad industry did what was necessary in every way to make the fact known?

The electric utilities have done just as splendid a war job as the railroads, if not better, and in an even more critical occupation because the moment power stops war industry stops. Has this fine record saved the industry from the encroachment of public power? No, it has not only received no medals for meritorious service from the hands of what should be a most grateful people, but it continues to be a target for unfriendly attacks.

Why should this be so? Largely because people do not know all the facts all the time. The other side is grinding out information and peddling it all the time. Private power must do the same and more and not wait.

So to answer our subscriber: Yes, it is time for all private utilities to get together on a national basis. It was time a year ago, five years ago, ten years ago. Each year that the industry waits something more is lost. The sooner the industry acts, the sooner will it strengthen its position in the battle for ownership.

Future Cooler-Loads Will Tax Distribution*

Prospect of 700,000 air-conditioners in five years and 1,500,000 home-freeze units in three years—A matter of concern to distribution engineers—Adverse load-factor and starting currents are noted—Joint study of accommodated programs urged

J. W. ANDERSON, Philadelphia Electric Co., Philadelphia, Pa.

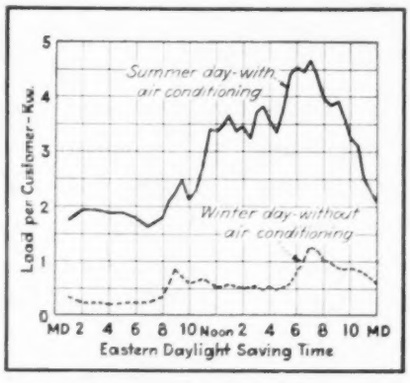
IF THE PREDICTIONS for post-war sales of domestic air conditioning and home-freeze units materialize, a major service problem will confront electric utility distribution engineers. Characteristics of the loads and of the motors likely to be used to drive the requisite refrigerant compressors are such as to constitute a definite tax on the capacity of distribution systems to handle them without distress or deterioration of service. In short, the prospect warrants early consideration jointly by Edison Electric Institute and the Air Conditioning and Refrigerating Machinery Association, Inc.

Market, Forecasts

At the October 1944 meeting of the transmission and distribution committee of the Pennsylvania Electric Association, a representative of a leading manufacturer of refrigeration equipment presented a forecast which focussed attention on the scope and seriousness of the distribution problem. There are to be hundreds of thousands of $\frac{1}{3}$, $\frac{1}{2}$ and $\frac{3}{4}$-horsepower 115-volt motors with locked rotor currents approaching 60 amp. The problem is national in scope and warrants national attention. It will be to the mutual advantage of both the utility industry and of the refrigeration industry in its newer aspects to have the technical ramifications solved before the program begins.

Pre-war sales of residential air conditioners (generally individual room coolers) attained a national volume in excess of 40,000 units. Available figures indicate that 5,682 units were sold in 1940 and 42,641 units sold in 1941.

Various authorities of the air conditioning industry have made forecasts for the future and generally agree that sales in a very few years



TYPICAL WEEK-DAY load curves for average residential customer (with air-conditioning in summer, none in winter)

after the war should increase to 6 or 8 times those of 1941, i.e., 200,000 to 300,000 units annually, or to somewhere around a $60,000,000 volume. One forecaster (apparently more conservative than others) makes the following predictions for the post-war period:

Year	Sales
V plus 1	86,004
V plus 2	113,986
V plus 3	138,000
V plus 4	170,340
V plus 5	197,840
5 Year Total	706,170

He uses 13,500 as the minimum that will be sold the first year, based on $\frac{1}{2}$ percent of the families with an income of $5,000 or more, given in available statistics as 7.7 percent of the 35,000,000 families in the United States.

As to home-freeze units, strong user acceptance is anticipated, even though local locker plants become generally available. Forecasts place the national market in excess of 300,000 units the first year, with probably 1,500,000 in the first three years, although these figures may be subject to radical revision by new models of home refrigerators with frozen food compartments and the growth of daily door-to-door delivery systems of frozen foods.

Motor Sizes

Six leading manufacturers of room coolers agree that room coolers of the future will be driven by $\frac{1}{2}$-hp. and $\frac{3}{4}$-hp. 115-volt motors that need only to be plugged in to any convenient convenience outlet. There is no reason to believe that other manufacturers will not do likewise. Central plant air conditioners for entire homes may run to 2 hp. or 3 hp. with possibly 5 hp. required for extremely large homes. For combination winter heating and summer cooling, a $\frac{1}{3}$-hp. to $\frac{1}{2}$-hp. fan motor will also be required, together with the 1/6-hp. or smaller oil burner motor. However, central plant conditioners are expected to involve special house wiring.

For home freeze units, it seems

* Adapted from paper at recent joint meeting of the Transmission and Distribution Committees of Edison Electric Institute and Pennsylvania Electric Association. The author is a member of the latter.

Table I—Characteristics of Fractional Hp. Motors, 115 Volts, 60 Cycles, 1,725 Rpm.

From the Catalogue of a Leading Manufacturer

Nameplate Rating—hp.	Split Phase — Special Service						Split Phase — General Purpose						Capacitor Start — General Purpose					
	Efficiency		Pwr. Factor		Amperes		Efficiency		Pwr. Factor		Amperes		Efficiency		Pwr. Factor		Amperes	
	Full Load	1½ Load	Full Load	1½ Load	Full Load	Locked Rotor	Full Load	1½ Load	Full Load	1½ Load	Full Load	Locked Rotor	Full Load	1½ Load	Full Load	1½ Load	Full Load	Locked Rotor
1/6	50	53	54	57	4.0	28	63	64	69	73	2.6	20	62	63	60	66	3.0	16
1/4	57	58	62	65	4.8	38	65	64	74	79	3.4	23	65	65	66	70	4.0	21.5
1/3	64	65	62	67	5.6	41							66	67	67	72	5.0	31
1/2													69	70	69	74	7.2	43
3/4													70	70	70	73	10.4	58

to be agreed that motors will be 115 volts, with rating of 1/5 hp. or 1/6 hp. for 4 or 5 cu.ft. of storage up to ¼ hp. for 15 cu.ft. and ½ hp. for 24 or 25 cu.ft.

Home Air-Conditioning

Characteristics of central plant residential air conditioning load were found by tests on a number of installations on the Philadelphia Electric Co. System. From these tests, Constantine Bary of that company has made the following observations as applying to the average customer in a fully air-conditioned home:

(1) The total diversified load with air conditioning is more than 3½ times that of the December load without air conditioning.

(2) The diversified peak load occurs on a high humidity, high temperature day at 7 p.m. clock time (6 p.m. standard time). At the time of the system evening peak (6 p.m. clock time), it is about 98 percent of its absolute peak.

(3) The rated connected air conditioning load of the average residential customer may be expected to be about 3.65 kw., producing a non-coincident demand of 5.19 kw. and a coincident or diversified demand of 3.72 kw. It is of interest to note that the air conditioner demand is 142 percent of its rating.

(4) The annual energy consumption for the air conditioning load is 1,538 kw.-hr., of which about 33 percent is consumed in July, 50 percent in July and August and 84 percent in the five months from May to September, inclusive.

(5) Thus the annual load factor is about 3.5 percent based on non-coincident demand, and about 5 percent based on coincident or diversified demand.

(6) The increment demand of the customer's total summer load with air conditioning over his winter (or December) load without air conditioning, is 4.65 kw. for non-coincident demands, and 3.42 kw. for coincident or diversified demands. Comparing these values with those shown in (3), it will be noted that about 10 percent of the air conditioning demand in the summer is absorbed by the seasonal characteristics of the "remainder" load.

Fig. 1 shows comparative typical daily load curves for the average customers for a summer day with air conditioning and for a winter day without air conditioning.

Room Coolers

Individual room coolers have characteristics somewhat different from the central plant conditioner. Magnitude of the load will be considerably smaller, unless several units are installed for different rooms of the home (there are at least two cases in Philadelphia where two room coolers are in use). Individual coolers will in general be manually controlled. The effect of automatic control of air conditioning is evident in the summer day curve of Fig. 1 (91 percent of the installations tested had automatic control). With manual control, the unit, if in a living room, will be started possibly in the early afternoon and allowed to run until late evening; in a bed room, it may be used for a few hours in the afternoon while baby naps, and then run again most of the night, with or without some diversity of use with respect to a living room unit. Such unit or units will tend to give a block effect to the load curve, and it is doubtful if even a ¼-hp. room cooler with a demand of 140 percent or more of its rating can be superimposed on a summer day load curve without increasing its peak to a value greater than the winter peak without the cooling unit.

Central plant conditioners, and probably individual room coolers, will thus certainly require additional investment in the distribution system to serve them. With the customary block residential rate, the revenue derived will generally come from the last steps of the rate and studies have shown that because of the extremely low annual diversified load factor of this equipment, revenue thus derived is inadequate to cover the costs in the distribution system (including substations and local transmission) and for production of the energy required. Should air conditioning load require generation and bulk power system investment, the inadequacy of return of course becomes considerably more glaring.

Rate Stimulus

It appears, therefore, that rate adjustments or other modifications will probably have to be devised before air conditioning loads can be added in large quantities to the system residential load without economic loss. What solution will be devised is unknown but it is reported as being studied. But even at the expense of extra first cost and operating costs, many families will want the benefits and convenience of air conditioning and frozen foods in the home.

Supply of 2 to 5 hp. at 230 volts for a central plant home air conditioning system will often impose serious distribution problems. But, relatively few such installations are ex-

Table II—NEMA STANDARDS (MG8-101 and -102) for Fractional Hp. Motors, 115 volts, 60 cycles, 1,725 Rpm.

Nameplate Rating, hp.	Short Hour Service			General Purpose			Locked Rotor Current, Amperes
	Efficiency	Power Factor	Apparent Efficiency	Efficiency	Power Factor	Apparent Efficiency	
1/6	46	52	27	58	56	36	20
1/4	51	56	32	61	59	41	28
1/3	54	58	35	68	61	44	31
1/2	58	60	39	65	68	47	45
3/4	61	62	42	67	65	49	61

NOTE: Values apply at rated voltage, frequency and load. Efficiencies, power factors, and apparent efficiencies are minimum values and the product of efficiency and power factor cannot be less than apparent efficiency. Locked rotor currents are maximum values except for split phase motors used at present on washing machines and ironing machines.

Future Cooler-Loads Will Tax Distribution*

Prospect of 700,000 air-conditioners in five years and 1,500,000 home-freeze units in three years—A matter of concern to distribution engineers—Adverse load-factor and starting currents are noted—Joint study of accommodated programs urged

J. W. ANDERSON, Philadelphia Electric Co., Philadelphia, Pa.

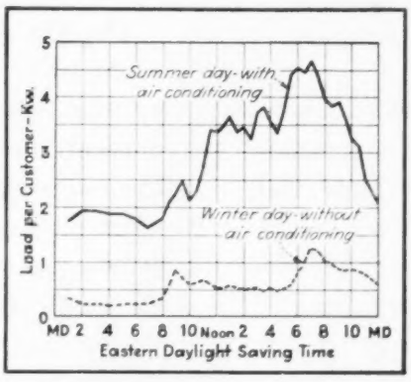
IF THE PREDICTIONS for post-war sales of domestic air conditioning and home-freeze units materialize, a major service problem will confront electric utility distribution engineers. Characteristics of the loads and of the motors likely to be used to drive the requisite refrigerant compressors are such as to constitute a definite tax on the capacity of distribution systems to handle them without distress or deterioration of service. In short, the prospect warrants early consideration jointly by Edison Electric Institute and the Air Conditioning and Refrigerating Machinery Association, Inc.

Market, Forecasts

At the October 1944 meeting of the transmission and distribution committee of the Pennsylvania Electric Association, a representative of a leading manufacturer of refrigeration equipment presented a forecast which focussed attention on the scope and seriousness of the distribution problem. There are to be hundreds of thousands of ¼, ½ and ¾-horsepower 115-volt motors with locked rotor currents approaching 60 amp. The problem is national in scope and warrants national attention. It will be to the mutual advantage of both the utility industry and of the refrigeration industry in its newer aspects to have the technical ramifications solved before the program begins.

Pre-war sales of residential air conditioners (generally individual room coolers) attained a national volume in excess of 40,000 units. Available figures indicate that 5,682 units were sold in 1940 and 42,641 units sold in 1941.

Various authorities of the air conditioning industry have made forecasts for the future and generally agree that sales in a very few years after the war should increase to 6 or 8 times those of 1941, i.e., 200,000 to 300,000 units annually, or to somewhere around a $60,000,000 volume. One forecaster (apparently more conservative than others) makes the following predictions for the post-war period:



TYPICAL WEEK-DAY load curves for average residential customer (with air-conditioning in summer, none in winter)

Year	Sales
V plus 1	86,004
V plus 2	113,986
V plus 3	138,000
V plus 4	170,340
V plus 5	197,840
5 Year Total	706,170

He uses 13,500 as the minimum that will be sold the first year, based on ½ percent of the families with an income of $5,000 or more, given in available statistics as 7.7 percent of the 35,000,000 families in the United States.

As to home-freeze units, strong user acceptance is anticipated, even though local locker plants become generally available. Forecasts place the national market in excess of 300,000 units the first year, with probably 1,500,000 in the first three years, although these figures may be subject to radical revision by new models of home refrigerators with frozen food compartments and the growth of daily door-to-door delivery systems of frozen foods.

Motor Sizes

Six leading manufacturers of room coolers agree that room coolers of the future will be driven by ½-hp. and ¾-hp. 115-volt motors that need only to be plugged in to any convenient convenience outlet. There is no reason to believe that other manufacturers will not do likewise. Central plant air conditioners for entire homes may run to 2 hp. or 3 hp. with possibly 5 hp. required for extremely large homes. For combination winter heating and summer cooling, a ⅓-hp. to ½-hp. fan motor will also be required, together with the 1/6-hp. or smaller oil burner motor. However, central plant conditioners are expected to involve special house wiring.

For home freeze units, it seems

* Adapted from paper at recent joint meeting of the Transmission and Distribution Committees of Edison Electric Institute and Pennsylvania Electric Association. The author is a member of the latter.

Table I—Characteristics of Fractional Hp. Motors, 115 Volts, 60 Cycles, 1,725 Rpm.

From the Catalogue of a Leading Manufacturer

Nameplate Rating—hp.	Split Phase — Special Service						Split Phase — General Purpose						Capacitor Start — General Purpose					
	Efficiency		Pwr. Factor		Amperes		Efficiency		Pwr. Factor		Amperes		Efficiency		Pwr. Factor		Amperes	
	Full Load	1½ Load	Full Load	1½ Load	Full Load	Locked Rotor	Full Load	1½ Load	Full Load	1½ Load	Full Load	Locked Rotor	Full Load	1½ Load	Full Load	1½ Load	Full Load	Locked Rotor
1/6	50	53	54	57	4.0	28	63	64	69	73	2.6	20	62	63	60	66	3.0	16
1/4	57	58	62	65	4.8	38	65	64	74	79	3.4	23	65	65	66	70	4.0	21.5
1/3	64	65	62	67	5.6	41							66	67	67	72	5.0	31
1/2													69	70	69	74	7.2	43
3/4													70	70	70	73	10.4	58

to be agreed that motors will be 115 volts, with rating of 1/5 hp. or 1/6 hp. for 4 or 5 cu.ft. of storage up to ¼ hp. for 15 cu.ft. and ½ hp. for 24 or 25 cu.ft.

Home Air-Conditioning

Characteristics of central plant residential air conditioning load were found by tests on a number of installations on the Philadelphia Electric Co. System. From these tests, Constantine Bary of that company has made the following observations as applying to the average customer in a fully air-conditioned home:

(1) The total diversified load with air conditioning is more than 3½ times that of the December load without air conditioning.

(2) The diversified peak load occurs on a high humidity, high temperature day at 7 p.m. clock time (6 p.m. standard time). At the time of the system evening peak (6 p.m. clock time), it is about 98 percent of its absolute peak.

(3) The rated connected air conditioning load of the average residential customer may be expected to be about 3.65 kw., producing a non-coincident demand of 5.19 kw. and a coincident or diversified demand of 3.72 kw. It is of interest to note that the air conditioner demand is 142 percent of its rating.

(4) The annual energy consumption for the air conditioning load is 1,538 kw.-hr., of which about 33 percent is consumed in July, 50 percent in July and August and 84 percent in the five months from May to September, inclusive.

(5) Thus the annual load factor is about 3.5 percent based on non-coincident demand, and about 5 percent based on coincident or diversified demand.

(6) The increment demand of the customer's total summer load with air conditioning over his winter (or December) load without air conditioning, is 4.65 kw. for non-coincident demands, and 3.42 kw. for coincident or diversified demands. Comparing these values with those shown in (3), it will be noted that about 10 percent of the air conditioning demand in the summer is absorbed by the seasonal characteristics of the "remainder" load.

Fig. 1 shows comparative typical daily load curves for the average customers for a summer day with air conditioning and for a winter day without air conditioning.

Room Coolers

Individual room coolers have characteristics somewhat different from the central plant conditioner. Magnitude of the load will be considerably smaller, unless several units are installed for different rooms of the home (there are at least two cases in Philadelphia where two room coolers are in use). Individual coolers will in general be manually controlled. The effect of automatic control of air conditioning is evident in the summer day curve of Fig. 1 (91 percent of the installations tested had automatic control). With manual control, the unit, if in a living room, will be started possibly in the early afternoon and allowed to run until late evening; in a bed room, it may be used for a few hours in the afternoon while baby naps, and then run again most of the night, with or without some diversity of use with respect to a living room unit. Such unit or units will tend to give a block effect to the load curve, and it is doubtful if even a ½-hp. room cooler with a demand of 140 percent or more of its rating can be superimposed on a summer day load curve without increasing its peak to a value greater than the winter peak without the cooling unit.

Central plant conditioners, and probably individual room coolers, will thus certainly require additional investment in the distribution system to serve them. With the customary block residential rate, the revenue derived will generally come from the last steps of the rate and studies have shown that because of the extremely low annual diversified load factor of this equipment, revenue thus derived is inadequate to cover the costs in the distribution system (including substations and local transmission) and for production of the energy required. Should air conditioning load require generation and bulk power system investment, the inadequacy of return of course becomes considerably more glaring.

Rate Stimulus

It appears, therefore, that rate adjustments or other modifications will probably have to be devised before air conditioning loads can be added in large quantities to the system residential load without economic loss. What solution will be devised is unknown but it is reported as being studied. But even at the expense of extra first cost and operating costs, many families will want the benefits and convenience of air conditioning and frozen foods in the home.

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NOTE: Values apply at rated voltage, frequency and load. Efficiencies, power factors, and apparent efficiencies are minimum values and the product of efficiency and power factor cannot be less than apparent efficiency. Locked rotor currents are maximum values except for split phase motors used at present on washing machines and ironing machines.

Table III—Refrigeration Motor Characteristics

Item	Manufacturer A		Manufacturer B		
	1/2 hp. unit	3/4 hp. unit	Home freezer	1/2 ton unit	3/4 ton unit
Volts	115	115	115	115	115
Running watts	700–875 (x)	1,000–1,250(x)	545	785	1220
Running amperes	8.1–10.1(x)	11.6–14.5 (x)	5.8	8.2	12.9
Running power factor	75%	75%	81.5%	83.5%	82.5%
Starting amperes	36.	50.	28.	35.	57.
Starting power factor	(y)	(y)	79%	81%	72%

(x) Maximum — occurring only under extreme temperatures.
(y) Not available but will use capacitor-start motors only.

pected. The bulk of the thousands of sales anticipated by the refrigeration industry will be in the "packaged" units requiring electric service for 115-volt motors with nameplate ratings of $\frac{1}{3}$ to $\frac{3}{4}$ hp. Probably only a very small percentage will be in the $\frac{1}{3}$-hp. group.

Motor Characteristics

Evidence available indicates that numerous types of motors have been applied to these equipments, but not always the best for the purpose from the standpoint of starting characteristics and long-hour operation. In Table I. attached, are shown various characteristics of fractional horsepower motors from the catalog of a leading motor manufacturer. These data are presented here only to show relative magnitudes of characteristics of several (but not all) types of motors that have or can be used. It will be noted that the most favorable motor in the nominal sizes proposed for room coolers will have locked rotor currents of 40 to 60 amp. Should cheaper motors be used, even these currents will be exceeded. For completeness, data from NEMA Standards are given in Table II. These are blanket standards applying to all types of motors.

It is not the intent to indicate that these are the motors that will necessarily be applied to future air conditioning units. The catalog data must be taken only to show relative characteristics among several types of motors; and list prices, which vary almost 2 to 1 for the motor types shown, might well be listed among the characteristics. The variations between types are significant in assessing possible future developments when more than 200 manufacturers of fractional horsepower motors and numerous manufacturers of compressor equipment operate in a highly competitive market.

For the purpose of this report, no attempt has been made to secure exhaustive data from the refrigeration industry on the characteristics of the motors they plan on using. Some data, however, have been made available (Table III) by two large refrigeration manufacturers, on their postwar units.

Table III indicates air conditioners must be considered a special motor application. In the first place, the motor is generally favorably situated with respect to cooling conditions and may be operated at substantial overload, insofar as nameplate is concerned. For example, tests on a $\frac{1}{3}$-hp. unit showed 585 watts input and on a $\frac{1}{2}$-hp. unit, 960 watts input, which after allowance for the small fan motor, represent a ratio of input to nameplate of 213 percent and 235 percent respectively. Another test, discussed below, gave 250 percent. No published data indicate efficiencies so low as to account for these ratios. In the second place, compressor designers usually require starting and pull-up torque characteristics sufficient to bring the equipment up to speed under extremely unfavorable pressure and supply voltage conditions. These torque characteristics are obtained only at the expense of increased starting currents, and generally the starting current will approximate locked rotor current.

Unloader

One manufacturer has announced the development of an unloader which can be applied to these units and which will materially reduce starting requirements. Until such a device is used universally, however, the room cooler motor must generally have both running and starting characteristics well beyond its nominal rating. It is significant that Manufacturer B in Table III has chosen to rate his equipment on a displacement basis rather than on a nominal motor nameplate which understates the demands of the device.

Test Results

As a preview of what may be expected, tests were made on a $\frac{1}{2}$-hp. window cooler installed on the lines of the Philadelphia Electric Co. in 1941. The unit also includes a 1/15-hp. fan motor.

The following characteristics were obtained, all values being read at the service entrance:

Starting voltage drop	5.5	volts
Starting current	34.4	amp.
Starting power factor	90.	percent
Running current	9.6	amp.
Running input	1035.	watts
Running power factor	94.	percent

No complaints from the operation of this unit are on record. It is favorably situated on the secondary, being only about 200 ft. (No. 6 wire) from a 40-kva. transformer. This transformer supplied 125 customers, of which only 16 are on the same secondary branch as the air conditioner.

The Future Problem

One unit—such as that tested—starting once or twice a day can and probably will operate for years without customer complaint from either starting or running conditions. But then project the proposed future industry sales of hundreds of thousands yearly over a period of years and establish saturation percentages as these sales occur—3, 5, 10, 15 percent, and do not necessarily limit them to the $5,000 income group, based on locations where they have already been installed in Philadelphia. Then add the fact that a large proportion of them will have nominally $\frac{3}{4}$-hp. motors with starting currents of at least 50 to 60 amp. Then add the fact that with modern interiors, lighting is no longer confined to the hours of darkness, and the fact that the use of voltage-sensitive fluorescent lighting will also increase. Then the fact that every customer on the transformer—whether he has an air conditioner or not—will see all or part of every flicker of every start of every air conditioner. Then add the fact that correction of secondary voltage regulation is frequently not only expensive but difficult to do physically.

These considerations alone point to a future distribution problem the consequences of which should be recognized now.

System and Controls of Synthetic Rubber Plant

Cooling, pumping, agitating and conveying operations entail explosive hazards necessitating extra safeguards in conjunction with standard industrial electrical equipment—Special processing control devised to maintain proportioning and sequencing

NELSON A. MOWRY, Blaw-Knox Co.†, Pittsburgh, Pa.*

PROCESSING of synthetic rubber involves application of electrical equipment to hazardous areas, continuity of service, strategic location of substation and special controls. The process involves the use of highly combustible hydrocarbons.

Electrical equipment used is of standard industrial types modified in some instances to suit requirements. The synthesis requires electrical energy for cooling, pumping, agitating and conveying functions. Careful consideration must be given the use of general purpose equipment located in or near the hazardous areas, in case no explosion-proof equipment for the particular application is available. Since a unit producing 30,000 tons of synthetic rubber per year has been established as the basic plant (under the Government program), this article will deal with a plant of those proportions. Plants of larger capacity are multiples of the 30,000-ton basic plant.

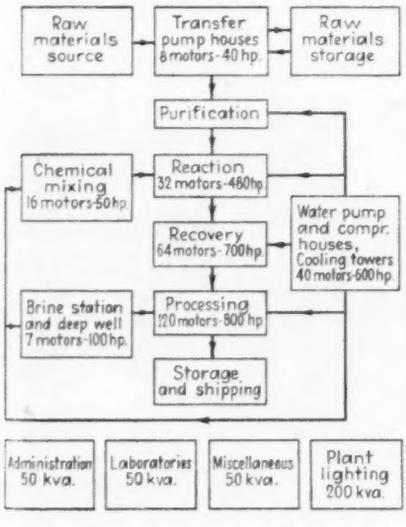

Raw materials source
Transfer pump houses 6 motors-40 hp.
Raw materials storage
Purification
Chemical mixing 16 motors-50 hp.
Reaction 32 motors-460 hp.
Water pump and compr. houses, Cooling towers 40 motors-600 hp.
Recovery 64 motors-700 hp.
Brine station and deep well 7 motors-100 hp.
Processing 120 motors-800 hp.
Storage and shipping
Administration 50 kva.
Laboratories 50 kva.
Miscellaneous 50 kva.
Plant lighting 200 kva.

FIG. 1—Process flow diagram and load distribution for unit 30,000-ton synthetic rubber plant

Power Distribution

The typical plant employs a radial system for power distribution and is subdivided electrically and chemically into two sections of 15,000 tons each. The incoming power is usually taken direct to the substation disconnects, transformed, and distributed with conventional types of metal-clad switchgear at 440 volts. In the larger plants the incoming power is terminated at a switching station. From this station feeders are run to the required number of division substations, and distributed in like manner. Connected load is approximately 3,000 kva.

Distribution Problems

The substation is kept at least 200 ft. from the hazardous areas and is never set at grade elevation; the floor is usually kept about 4 ft. above grade, and in some cases pressure ventilation is employed to prevent admission of explosive vapors. If the plant is located on natural sloping ground, advantage may be taken of this fact in coping with the problem of explosive vapors which are heavier than air. Underground ducts are considered the safest and best method for running main feeders about these plants. A slight variation from common practice is the use of sealing-type covers on all manholes. By removing the top cover and using a safety lamp, presence of gas can be detected and purged out. Then the sealing cover can be removed to determine whether gas has leaked into the manhole proper. Cable pits, trenches, etc., are not tolerated in the hazardous areas. Duct lines are all sealed at each manhole with a mixture of cement and asbestos.

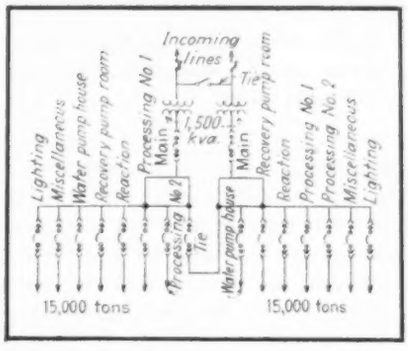


FIG. 2—Primary and secondary crossties for two lines each feeding a 15,000-ton section

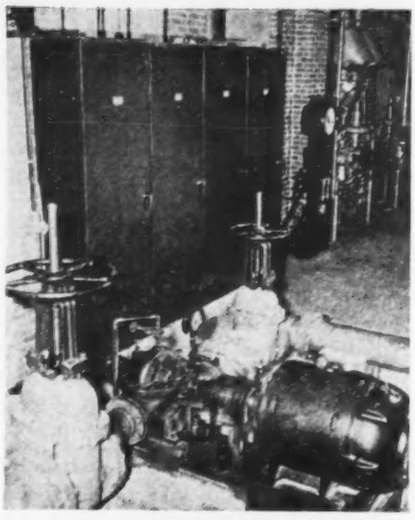
Motor Control and Panelboards

The same general methods used in the construction of the substation apply to the motor control equipment rooms. Greater economy, safety, and easier maintenance are obtained by keeping all motor starting equipment at a safe distance from the hazardous areas. On this basis the use of general purpose type of equipment becomes quite feasible. Two ad-

* Process engineering, development department, Blaw-Knox division.
† Designing Engineers for Defense Plant Corporation.

U. S. Rubber Co. photo

FIG. 3—Starter panelboards for motors on pumping and processing equipment are placed back to back



U. S. Rubber Co. photo

FIG. 4—Motor starter cabinet in water-pump house; watertight equipment housed in cabinet →

ditional advantages thus accrue since general purpose gear is not heavy and can be elevated for additional safety; it also lends itself to the unit cubicle form of motor starter panelboard, which feature greatly facilitates installation problems. One apparent drawback is the congestion of conduits coming to such a centralized control panelboard but this trouble can be offset to some degree by judicious use of junction boxes.

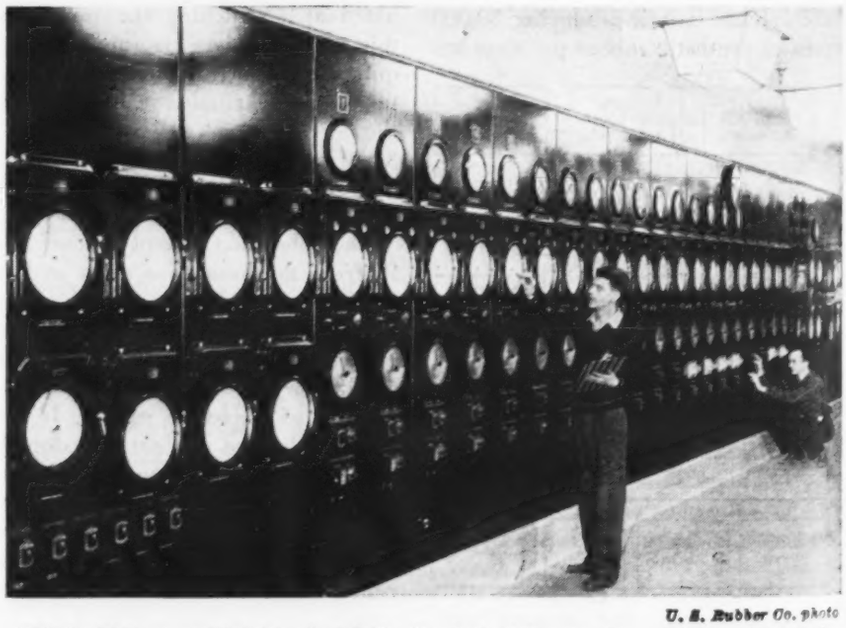
General purpose type motor control panelboards used are self contained dead-front unit type of motor starters with air-circuit breakers or fusible knife switches in combination, mounted in cubicle units. The selection between air-circuit breakers and fusible knife switches was dependent upon the choice of the operating company's engineers. All the starters have safety lockout features, and each is equipped with a 110-volt control transformer. This type of control board facilitates maintenance as a few extra starters may be carried in stock, and should the occasion demand, units are easily replaced. Boards have vertical, top, and bottom gutters, with terminal boards located in either the top or bottom gutter, also adding to the ease of installation and maintenance.

Motor sizes average one-third under 3 hp., one-third at 3 hp., and one-third over 3 hp., the largest usually being about 200 hp. Some trouble was experienced with lowered power-factor caused by a large number of small induction motors involved in pumping operations. This trouble was overcome by the use of synchronous motor drives and capacitors.

Control Systems

In order that the various re-agents used in the reaction process can be combined quickly and accurately, a system of proportioning pressuring pumps, and proportioning meters was arranged. Signal lights on the main processing control board show the operators that the pumps and meters are functioning properly. The volume proportioned into the solution is determined by the setting of the proportioning meters. The volume and pressure of the pumps is constant. In order to give the pumping system the desired flexibility of group or independent starting, stopping, or running, a scheme (Fig. 6) was worked out and has proven entirely satisfactory. Various gages on the main processing control board in conjunction with the signal lights gives the operators close control over this very important operation.

Pumps transfer large quantities of solution and run for extended periods of time, and the operation should therefore be accomplished with the least amount of supervision. In order to effect these results a relay system in conjunction with a magnetic



U. S. Rubber Co. photo

FIG. 5—Main processing board controls chemical mixing reaction, stripping (removal of unreacted components) and emulsion transfer

flow-alarm was set up. To transfer control by use of the flow-alarm, a relay with one normally open and one normally closed contact was used, one side of the coil being connected to the contact arm. (See Fig. 8.)

Upon depressing PB-1 the relay TR-R is energized and transfers from a-1 to b-1. It is then maintained through flow-alarm FA. CR-2 is picked up closing the motor control circuit and starting the pump motor. When the pump has built up a rate of flow, the flow-alarm moves from contact "a" to "b", causing the signal light to go off and the pump motor to stop. PB-1 and PB-2 are located on the main control board, PB-2 being for emergency stop. PB-3 and PB-4 are located near the pumps.

For controlling the length of the chemical reaction, cycle timing relays were used. Duplex control of the agitating motors was provided for operation from the main processing control board or from the reactor vessel.

An interlock S-1 was provided to pick up the cycle timer clutch coil TC which in turn closes contact TC-1, starting timer drive motor TM. Upon the completion of the cycle, motor TM unlatches TC-1, stopping itself, closes TC-2 lighting signal light SL, identifying the vessel in which reaction is complete. Light PT is also energized causing a photo-electric relay to function; a second relay (not shown), blows a whistle, assuring the operator's attention of the fact of a completed reaction. Push button RB when opened at the completion of the cycle, causes timer clutch coil to open contact TC-2, returning the timer to normal position. Vessel agitating motor is then stopped. This scheme was employed in the control of quite a number of motors.

In order to remove the great quantity of water held by the spongy rubber floccules, the mass is passed through squeeze rolls, then shredded by spiked rolls and carried on conveyors through dryers. (See Fig. 10.)

The dryer fans (S_1 S_2) are group started, each being protected by a manual starter. A control relay CR was used in starting the conveyors (C_1, C_2) which are interlocked to prevent material pile-up. When the fans and conveyors in the dryer are functioning the feed conveyor FC can be started. Breakers D_1 and 4_2 are spiked rolls which chew up any large chunks of rubber crumbs coming off the ends of the conveyors. BR_1 and BR_2 are wire brushes which remove small crumbs sticking to the conveyors. A fire alarm or high temperature relay closes contact FCR upon high temperatures. Relay FAR_1 is then energized, sounding an alarm and causing a solenoid valve to be energized on the steam fire quenching system.

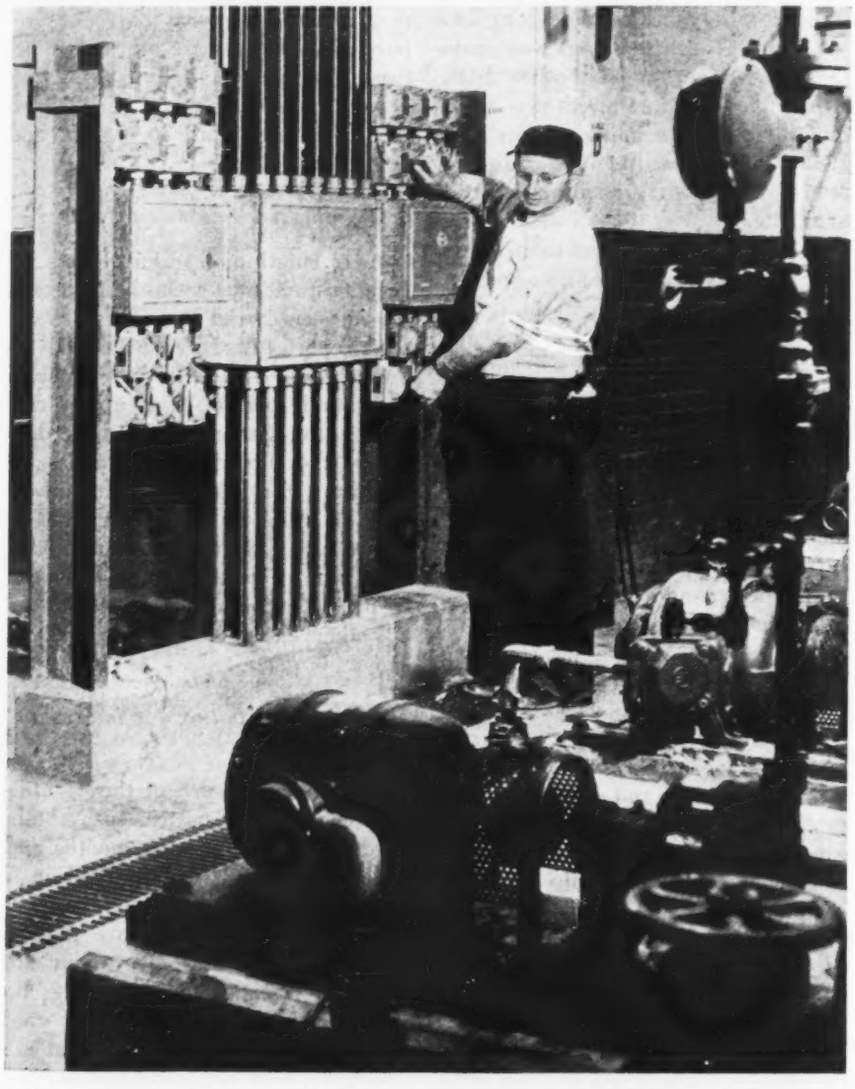


FIG. 7—Control station in chemical mixing pump room. Semi-hazardous area. Watertight equipment guards against dripping and possible vapors.

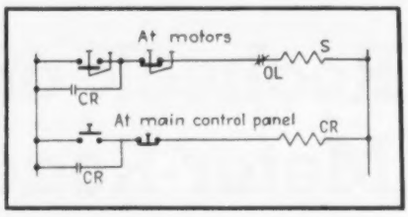


FIG. 6—Control scheme gives pumping system desired flexibility of group or independent operation (See Fig. 7)

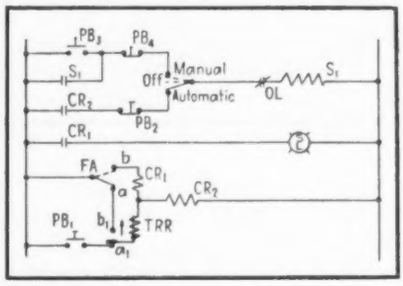


FIG. 8—Minimized supervision achieved for solution transfer pumps by this flow-alarm scheme

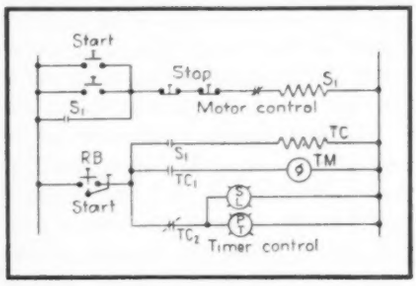


FIG. 9—Cycle timing relays fix duration of chemical reaction

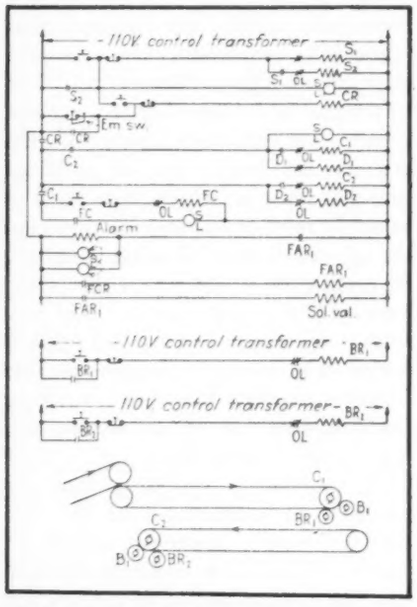


FIG. 10—Interlocking control of dryer fans and conveyors

Recheck on Longer Meter-Reading Periods

Experience of two additional years corroborates findings of first survey—Economies are being realized and, regarding it as a war-time expedient, customers accept the practice without too much complaint

READING METERS less frequently than monthly appears generally to be a satisfactory expedient to conserve auto mileage and manpower in time of war, but only an expedient. This was a conclusion stated in the article, "Experience with Longer Meter-Reading Periods," (ELECTRICAL WORLD, April 17, 1943, page 64) based on a survey made at that time. Now, two years later, a recheck survey has been made and the conclusion is corroborated.

The first survey was made before any great amount of experience had been accumulated and its findings could not be taken as much more than indicative. It was the purpose of the second to discover if those indications had been proved to be correct and if anticipated results had been obtained.

The recheck shows that expected economies have been realized, that while bill complaints have increased they are not a great difficulty, that loss of revenue is not found to be a general result, that customers appreciate the reasons for longer period readings and that most utilities will go back to monthly readings as soon as they can. As appears in the following summary of replies, there are exceptions, some very radical exceptions, to these general conclusions. But by and large it seems that going to longer periods of meter readings has been a war-time move productive of economies and acceptable to customers.

A noteworthy condition that appears from comparison of the two surveys is the apparent growth in favor of bi-monthly reading and billing. In 1943, 6 out of 69 replies, 8.7 percent, reported this practice; now the proportion is 11 out of 43, 25.6 percent, the proportion multiplied nearly three times.

Only two instances of outright condemnation of longer period readings were reported. (See Notes (4) and (9) below the table.) In one, complete return to monthly readings was made October, 1944. In the other high school boys were hired to make monthly readings in the summer of 1944 and now as many meters are read monthly as is possible with help available.

In comparison with the earlier survey, which showed 12 (17.5 percent) of 69 companies reading all urban and rural meters at longer intervals, the recheck shows 16 (37 percent) of 43 with extended reading periods applying to all or practically all urban and rural customers. This increase, which is actual, not only proportionate, probably indicates that satisfactory experience with longer period rural meter readings has caused some companies to adopt the practice for urban meters also.

1. *Time of change to longer reading period.*

The earliest change reported was in 1941; 21 occurred in 1942, 20 in 1943, 3 in 1944 and 1 is scheduled for April, 1945. In 15 cases changes were made applying only to rural customers, in 3 cases only to urban customers and in 25 to both urban and rural.

2. *Proportions of customers affected.*

Of the 43 replies, 11 report all urban and rural customers affected by the change, 5 others report practically all. In 23 cases all rural service is on the longer period basis and in 7 others 90 percent or more. In 4 cases 20 percent or less of rural customers are affected. And in the 4 remaining instances of rural service change the percentages are 50, 70, 73 and 86. As regards urban service 13 replies report all customers are affected, 4 between 90 and 100 percent, 3 only 15 percent or less, 4 are 50 percent and the remaining 4 are 56, 64, 70 and 80 percent.

3. *Reading periods.*

As to length of reading periods for rural customers, it seems to be a toss-up between 2 and 3 months; 19 replies reported 2, 16 said 3 and 1 reported both. Only 3 replies reported a 6-month period. For urban customers the 2-month period is definitely the favorite, 23 replies as against 6 for 3 months. In only 2 cases in which a longer than monthly period is applied to both urban and rural service is there any difference in period as between the two, in the 23 other cases the periods are the same.

4. *Methods of billing for intervening months.*

Less than half, 19, of the 41 utilities reporting use postcards to obtain readings for intervening months and of the 19, postcards are used in 7 cases only when requested by customers. Estimated bills are regular practice in 23 cases; in 3 they are rendered when postcard readings do not come in on time. In one case (See Note (6) below the table.) "budget" bills are rendered for intervening months. In 11 cases both readings and billings are bi-monthly.

5. *If postcards are used what was average percent of returns in first few months and what is it now?*

Categorical replies to this question were received from 11 utilities, 2 reporting improvement in postcard returns as time went along, 2 others no change and 7 declines in returns in the following terms: 95 percent down to 87, 95 down to 85, 86 down to 60, 85 down to 82, 83 down to 80, 77 down to 65 and 60 down to 41. Without giving any figures, one utility reported having used postcards for a long time with very good results. The 12 utilities included in the foregoing evidently are among those who use postcards regularly to obtain intervening readings. Two additional reports were received from companies who use postcards only for those customers who express preference for them over estimated readings. In one case 8 percent of customers wanted to supply postcard readings at first but most of them tired of it very rapidly and the proportion is now down to 3 percent. In the other case the proportion dropped from 10 percent to 5.

6. *Are rural customers' bills particularly difficult to estimate?*

To this question 28 replies were received, 12 "yes" and 17 "no", too small a cross-section to justify a positive opinion in the matter, although the indication is negative.

7. *Have bill complaints increased? How much?*

Increases in bill complaints are reported in 22 replies, no increases in 19. Considering that of the 22, one said that the increase was "negligible", another "moderate", another "insignificant" while 5 others reported 15, 10, 10, 10 and 3 percent, it does not appear that this factor can be accepted as a strong argument against longer meter reading periods. Over against this conclusion, however, is the fact that one company reported a 1,000-percent increase, 2 reported 200 percent, three reported 50 and 2 more used the word "substantially" and "greatly" to indicate the increase in their cases.

8. *Have anticipated economies in auto mileage and man-power been realized?*

There seems to be no doubt about it: 37 replies said "yes" to this question and one more said "approximately". There was only one unqualified "no"; it said the anticipated economy had been only 50 percent realized. Another said the economy had fallen 20 percent short of expectation because men had to be sent into the territory to collect bills.

9. *Has estimating bills resulted in any ascertainable loss of revenue?*

Neither does there seem to be any doubt that loss of revenue is no argument against longer meter reading periods. Of 33 replies to this question only 2 characterized loss of revenue as substantial and in excess of savings realized by the longer period. There is a loss, according to 4 others, but it is less than the saving. "Don't know" said 3 replies and 24 asserted no loss of revenue.

10. *Have customers indicated any general feeling for or against longer-than-monthly reading periods?*

It appears that customers are accepting longer reading periods pretty generally as a war measure. Of 39 replies to this question 17 said that no general opinion among customers was observable and 10 reported customers approved because of the war. Some feeling against the longer period was reported in 14 of the replies.

11. *Will you return to monthly readings when conditions permit?*

Nearly half, 20, of the 42 replies to this question said yes, 7 said probably and 10 said don't know or undecided. Of the remaining 5, one said probably no, another said no without any qualification and 3 said not unless required to do so.

Meter Reading and Billing Practices

Reply No.	Changes Made		Customers Affected %		Reading Periods—Mo's.		Methods of Billing for Intervening Months		
	Rural	Urban	Rural	Urban	Rural	Urban	Post-Card Readings	Estimates	No. Billings
1	11-42	11-42	86	64	2	2		x	
2	10-42	10-42	100	100	2	2	x (1)	x	
3	8-42	8-42	100	100	2	2		x	
4	6-42	6-42	100	50	3	3	x		
5	9-42	9-42	100	56	3	2		x	
6	7-42	7-42	95	95	3	3		x	
7	7-42	5-43	98	50	2	2			x
8	10-42	10-42	94	94	3	3	x (1)	x	
9	4-42		100		6		x		
10	1-43		100		3			x	
11	10-42								
12	10-42	10-42	100	100	2	2		x	
13	6-42	6-42	100	100	2	2		x	
14	1-43		50		6		x (1)	x	
15	9-42	9-42	90	50	2	2	x	x	
16	1-43		100		3			x	
17		12-42		100		2		x	
18	5-43	5-43	100	15	3	2		x	
19	9-43	9-43	100	100	2	2	x (1)		x
20		10-42		100		2	x (1)	x	
21		6-43		50		2			x
22	-42		9			3	x	x (2)	
23	9-43	9-43	100	100	2	2			x (3)
24	1-43		100		3 (4)		x (1)	x	
25	11-42		100		3			x	
26	2-43		100		3		x	x (2)	
27	4-45		100		2				x (5)
28	10-42	6-44	98	10	2	2			x
29	1-43	1-43	100	100	2	2		x	
30	4-42		70		2		x	x (2)	
31	1-43	1-43	100	100	3	3		N (6)	
32	1-44	1-44	90	7	2	2			x (7)
33	4-44			100	3		x		
34	10-44	10-44	100	100	2	2			x
35	10-42			16	3		x		
36	-41			73	2-3		x (8)	x (8)	
37	8-43	8-43	95	95	2	2			x
38	1-43	1-44	100	100	3	3	x (9)	x	
39	3-43	3-43	20	80	3	2	x (1)	x	
40	9-43	9-43	100	97	2	2			x
41	3-43		10		3		x		
42	-42	-43	100	70	2	2		x	
43	10-43	10-43	100	100	2	2			x

Notes:
(1) Normally bills are estimated, but customers may elect to send in postcard readings.
(2) Bills are estimated if postcard readings are not received.
(3) Bi-monthly reading and billing adopted after experimenting for about a year with monthly postcard readings which were found to be extremely unsatisfactory because of special local conditions.
(4) Started to change back from quarterly to monthly reading in summer of 1944 and now reading monthly as many meters as is possible with manpower available.
(5) Bi-monthly billing will be put into operation in April this year after unsatisfactory experience with estimates and customer readings for intervening month.
(6) Bills for intervening months not estimated and no figures of kw-hr appear on them. They are "budget" bills for one twelfth of total payment in 1942.
(7) Bi-monthly reading and billing adopted after unsatisfactory experience with quarterly reading and averaged intervening bills.
(8) Estimated readings used in bi-monthly group; postcard readings in quarterly.
(9) Postcard readings discontinued after first year when experience showed them ineffective with urban customers. Because of unsatisfactory experience with longer period, returned to monthly readings October, 1944.

Fault Current-Distance Curves Help Locate Transmission Trouble

Methodical determination of fault location on 270-mile, 154-kv. transmission line enables dispatching of repair crews to the area in which the fault occurred—Outages and patrolling curtailed

C. S. ROADHOUSE* and O. R. HANTLA*

RIGOROUSLY calculated fault current distance curves that approximate the location of transmission line faults from the magnitude of the resulting short circuit current appearing at line terminals, are in use on the 270-mile Omaha-Midian 154-kv. transmission line. These curves were designed to speed the dispatching of repair crews, to cut emergency line patrol time to a minimum and to reduce extended outages on this important transmission link between the system of Nebraska Power and Kansas Gas & Electric.

Short circuit data for actual faults on this line are recorded at each terminal by a six-element PM-13 automatic oscillograph of the type shown. Each oscillogram records two-phase voltages, three-phase currents and the residual current. Both overcurrent and undervoltage initiation are used at each line terminal to start the oscillograph at times of fault.

Whenever a transient or a sustained fault occurs on the line the oscillogram at each terminal is removed to the dark room and developed immediately. A brief examination then reveals the type of fault and the magnitude of the fault currents. This determines which fault current-distance curve should be used to estimate the distance to the fault. A check is also made by carrier telephone on the results obtained at the terminals in order to determine whether they check as to the approximate location of the fault. This is done before either dispatching a patrol over the line or sending a repair crew out.

To convert the deflections on the oscillogram to line amperes, calibration curves were made for the oscilloscope. Three were required; one for neutral current, one for phase current during three-phase or two-phase faults, and one for phase current during phase-to-ground faults.

Phase currents measured during staged fault tests on this line correspond fairly close to the phase currents measured on the analyzer. The difference was never over 5 percent. There was some discrepancy, however, between the neutral currents measured during the staged faults tests and those measured on the analyzer. This difference was attributed to the current transformer

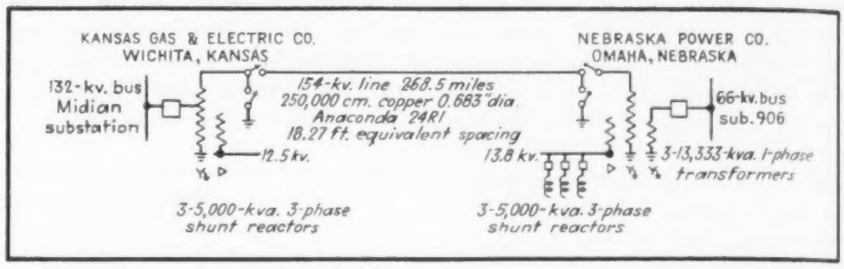
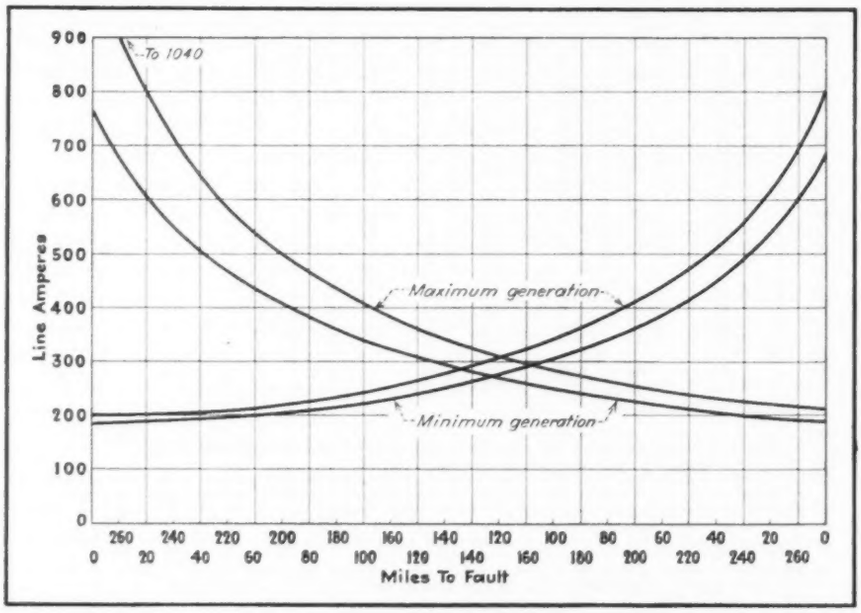
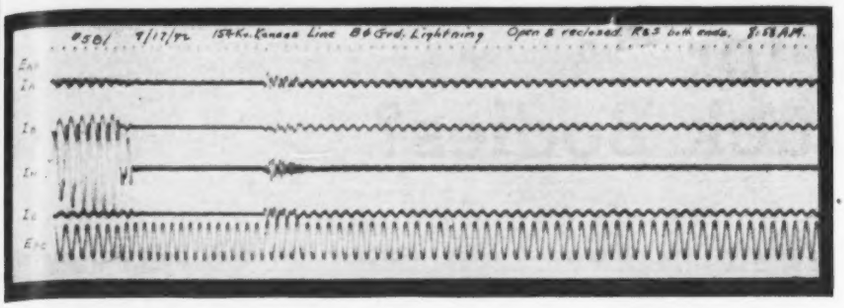


DIAGRAM of Midian-Omaha power interconnection



ONE-WIRE-TO-GROUND, fault current-distance curves reveal approximate location of fault along the line corresponding to a particular fault current measured at the line terminals. Curves were developed from calculating board study.

* Substation Engineer, Nebraska Power Co., Omaha, Nebraska, and Technical Engineer, Kansas Gas & Electric Co., Wichita, Kansas, respectively.



OSCILLOGRAM OF A TRANSIENT FAULT from "B" phase to ground

ratio used in making up the calibration curve for the neutral current. It is believed that if the correct current transformer ratio were used, the two values of neutral current would have checked fairly close.

A comparison of fault currents was obtained on the network analyzer with and without arcing resistance. The small difference in the current values indicated that any inaccuracy incurred by neglecting the fault resistance would be less than the accuracy originally expected of the curves.

Degree of Error

Due to the shape of the curves, one can see that as the location of the fault approaches the remote end of the line, the possibility of error increases due to the increase in distance per ampere change of fault current. Because of this, the location as indicated by the set of curves nearest the fault is considered more nearly correct than the location as indicated by the curves at the remote end of the line. Consequently, system operators at each end of the line check with each other to determine if they agree on the approximate location of the fault before instructions are issued relative to patrolling the line.

In considering all the possibilities which can enter into the picture in determining the location of a fault, it is not expected that the distance will be within a few yards of the fault by using this method. It is expected, rather, that the distance can be determined within five or ten miles which is, after all, a great help on a line 270 miles long.

Constants Calculated

Positive, negative, and zero sequence A.B.C.D. constants used in the calculating board study were calculated from data obtained from actual open-circuit and three-phase short circuit faults made on the 154-kv. line. The positive, negative and zero sequence impedance for each quarter (67-mile) section of line was calculated using the "short line" method. A check of the error involved in using the "short line" method indicated this error to be approximately one-third of one percent. The equivalent positive, negative and zero sequence impedance for maximum, medium, and minimum generating conditions was calculated for each system. This basic data was arranged and set up on the network analyzer. As a check on the proper analyzer settings and terminal conditions, a normal three-phase power flow diagram was made and checked against the power circle diagrams of the line and against actual conditions already experienced.

Data used for plotting the fault current-distance curves was obtained at each terminal and with the line closed at both ends. For our own information and for comparative purposes, other tests were made and data taken on the following five items:

(a) Faults which included arc resistance.

(b) Faults with the line open at one end only.

(c) Voltage and current values at each quarter-way point.

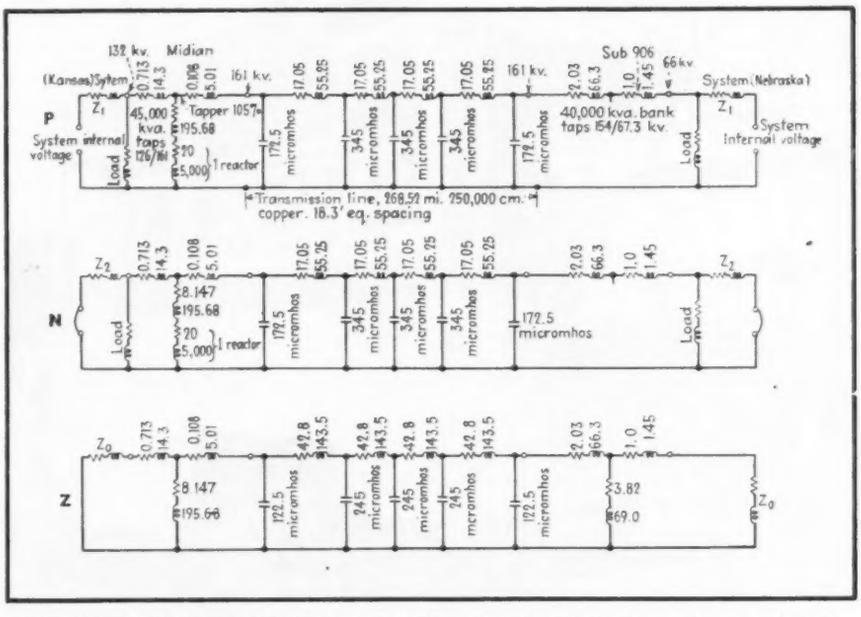
(d) Angular difference for various load flows over the line.

(e) Pull-out test with normal voltage maintained at each terminal.

Line Performance

This line was placed in service in August, 1942. Since that time, the line has experienced only two tripouts and was successfully reclosed in each case. The cause of these tripouts or the location of the faults was never determined. No damaged or blistered conductors were found when this line was patrolled. Our only reason for this is that due to the fast relays and breakers on this line, these transient faults were extinguished before any visible damage could be done. The only assurance that we have that these curves will be fairly accurate when the proper time comes, is that the current values measured during the staged fault tests correspond fairly close to the values on the fault current-distance curves.

The calculation of the basic data and the procedure followed on the network analyzer was under the supervision of C. A. Streifus, Electrical Engineer of Ebasco Services, Inc., New York City.



NETWORK ANALYZER SET UP for the Midian-Omaha 154-kv. line; ohms are based on 161 kv. P-positive sequence; N-negative sequence; Z-zero sequence

What Metal for Post-War Truck Bodies?

A progressive utility truck body designer discusses post-war metals in light of experience with aluminum and high-strength low alloy steels War developments in light alloys might change post-war practice

FRED S. BEACH, Mechanical Engineer, Northwestern Electric Co., Portland, Ore.

MUCH THOUGHT is being given by utility automotive engineers to truck body design, post-war, and to the metals which will be available for their fabrication. Predicting possibilities in truck body and accessory equipment for 5 to 10 years after the war is a long way ahead to make a very accurate prediction of what will be economical and equally or more durable than we now have.

However, past experience with metal bodies with which the Northwestern Electric Co. has had experience, inclines the writer to express the view that of the three types involved, viz., high-strength aluminum, popularly known as Duralumin; mild sheet steel, and high-strength low alloy, corrosion resistant, sheet steel, the last mentioned seems to be the one most suited to making a durable body of required ruggedness, reasonable cost and not excessive in weight. This is especially true when all parts are brake-formed or pressed without rolled structural shapes of any kind, and that are welded into a solid assembly. This was proven in the case of bodies we built in 1938, in that first cost and maintenance were soundly economical, not only as referred to the body structures themselves, but in overall truck unit cost and maintenance.

With structural shapes and sheets of high-strength aluminum, the method of construction now requires riveting of the various members. There were over 1,300 rivets required to assemble the frame of a Dural composite body using wood for bins and filler panels with canvas roof curtains built in 1930.

ALUMINUM RIVETED BODY on Ford A-A chassis built in 1930, now out of service because of chassis wear. Service weight of body only 880 lb.

Whatever objections the writer may have at present to the use of Dural may be overcome in time to come because there is a possibility that the aluminum metallurgists may develop a high-strength aluminum which can be arc welded and brake formed without weakening the parts. If this is accomplished and the unit cost of the material is reduced comparable to high-strength steel, then aluminum will be a logical material for body construction because of the very light weight.

At present, the Aluminum Company of America produces two types of high-strength aluminum. One known as "Alclad" is plated with pure aluminum which resists corrosion even in salt air atmosphere and requires no painting. It costs slightly more than the regular high-strength aluminum which requires the same preparation for painting as with steel, beginning with the priming or foundation coat, then the intermediate and finally the outer coat. All joints in a body structure of regular unplated high-strength aluminum must be prepared "water clean" and coated with bituminous aluminum paint on the surfaces of both parts where they join, dipping the rivets used before driving. Such coating should seal the inner edges of rivet holes as otherwise moisture entering the joint and penetrating between the

PIONEER MILD SHEET STEEL BODY built in 1930 and still in service with no appreciable deterioration. Structural members were brake-formed and all joints are welded. Body weighs 1,660 lb., and was 625 lb. lighter than previous lightest composite wood body. Canvas used for roof and curtains

rivet and the hole surfaces will begin progressive corrosion.

From this it is obvious that these various items add to the shop cost of building an aluminum body. Fundamentally, high-strength aluminum of this period derives its strength through heat treatment and possesses little strength over plain aluminum if the temper is drawn. It also has a quality of work hardening which occurs in brake-forming sheet stock unless liberal bending radii are used. Sharp corner bending cannot be done without cracking on the knuckle of the bends.

High-Strength Steels

There are four main varieties of high-strength low alloy steels made by four of the large steel companies. "Cor-Ten," which was the material used in bodies we built in 1938, is a product of the United States Steel Corporation. "Mayari-R" is a Bethlehem Steel Company product; "Yoloy" is made by Youngstown Sheet and Tube Company and "Dy-Nel" is a product of Allen-Wood. The first three have been available from local stocks and are still to be had under WPB restrictions, but in a limited number of gages. These are similar as to physical properties and all are corrosion resistant. The yield strength is 50,000 psi with an ultimate of 70,000 psi, or better, and the corrosion rate is about 25 percent that of mild steel. The sheet stock of all three responds readily to brake forming nearly as well as the softer mild steels of ordinary structural strength. However, the inside corner radius of a right angle bend should not be less than the equivalent of two thicknesses of the stock being formed. Furthermore, to form at right angles, it is necessary to bend slightly beyond 90 deg. to allow for spring back.

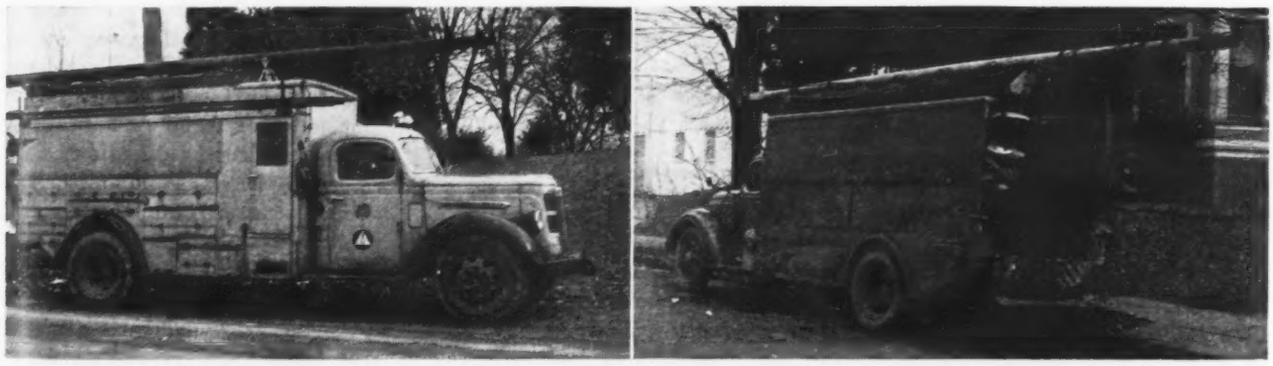
All three can be electric welded either by the arc, spot or shot weld methods when properly done without loss of strength in or near the welds. In an all-metal body, corrosion is one factor that determines its relative durability.

A designer using a high-strength low alloy steel with formed instead of rolled shapes for structural members can develop a design for any type of body projected which will save practically one-third of the weight which results when the same body is built of common mild steel sheet. This is not because the high-strength steel itself has a lighter weight, but because most members of construction can be made in thinner gages than would be necessary when using mild steel sheet. This fact is obvious when comparing the bodies built by my company in 1938, with a later body built with mild steel sheet in 1941. The Cor-Ten bodies weighed 1,958 lb. net, whereas the mild steel body of 1941 weighed 3,000 lb., plus, both designs being comparable as to size and capacity.

Adequate Strength

There is one item a designer must not overlook when planning a body from high-strength low alloy steel. In his eagerness to reduce weight he must not overlook checking his strength calculations to determine whether or not a member is stable against web failures and buckling from lateral deflection. High-strength low alloy steels have a modulus of elasticity averaging 29,000,000 psi., the same as mild steels of structural grades. Hence, it is better to be safe and select at least one gage heavier than the minimum indicated by results of the strength calculations.

Experience with both high-strength aluminum alloys and high-strength low alloy steel sheet shows that if cost and weight are both to be saved, then high-strength low alloy steel sheet fabricated with brake-formed parts and electric welding at the joints accomplishes better overall results.



HIGH-STRENGTH, LOW ALLOY SHEET STEEL line truck bodies. All members brake-formed with welded joints. Left: Body built in 1938. Body weight, 1,958 lb. Empty weight of unit, 9,060 lb. Right: Body built in 1941, for any character of line work. Body weight, 3,000 lb. Weight of empty unit, 10,000 lb.

Reactive Metering and Control Nomenclature

In and out designations for both active and reactive flow advocated to clarify the present confusion—Advantageous departure from standard terminology offered as a contribution to the re-opened discussion

A. L. CARVILL, *Ebasco Services, Inc., New York, N. Y.*

CONFUSION FREQUENTLY exists in negotiating and administering power agreements with customers and for interchanges, in system operating procedures and in discussions of system design because of different concepts of "power factor" and the use of variant terms to designate reactive power flow and measurement. Uniformity in use of terms and in metering methods would facilitate every-day dealings in such matters.

Designation of reactive power has been frequently a subject of discussion, both from the theoretical and practical viewpoints, including an AIEE symposium held in 1933 and various articles that have appeared in the technical press.

It is the purpose of this article to re-direct attention to this subject and to discuss the clarity and simplification provided by the "in" and "out" nomenclature. It may be used to designate both active and reactive power flow and may be applied to metering on all parts of the system. While the practicability of this nomenclature is often recognized, a more general acceptance of the idea throughout the industry would do much to promote common understanding and uniformity of methods.

Active and Reactive Power

To obtain proper load and voltage control for efficient system operation, it is usually necessary to know the sources, magnitudes and directions of both active and reactive power. This power flow is frequently thought of in terms of kilowatts and power factor. However, the alternate concept of active and reactive power as two separate components of electrical load is rapidly gaining acceptance because of the clarity and other advantages this concept provides.

Reactive power is represented by reactive volt-amperes (var), kilovars (kvar), or megavars (mvar). Reactive power is caused by either the inductive reactance or capacitive reactance of a circuit and together with the active power flow into the circuit it can be considered as lagging in an inductive circuit and leading in a capacitive circuit. For example, a synchronous motor may be taking active power from a system together with lagging reactive power when underexcited or leading reactive power when overexcited.

Customer Metering—One Direction

Metering of customer loads or other loads where the active power flow is in one direction only is relatively simple and the convention of lagging and leading reactive power is convenient to understand. Usually, with customer metering, it is not necessary to measure leading reactive power, provision being made for metering active power or kilowatts and lagging reactive power or kilovars only, which with the convention subsequently discussed can be considered as kilowatts "in" and kilovars "in." This is shown in Fig. 1.

Tie-Line Metering—Both Directions

Metering of interconnections or tie lines where active power or kilowatts may flow in either direction, "in" or "out," is considerably complicated if it is desired to retain the convention of lagging and leading kilovars. Considered in relation to the simultaneous direction of kilowatt flow, lagging kilovars may be "in" or "out," and leading kilovars may be "in" or "out." Thus there are four quantities of reactive power in addition to two quantities of active power between which the measurement must distinguish. These relations are shown in Fig. 2.

A convention that leads to less confusion is to consider the general term "reactive power" as applying only to *magnetizing* reactive power or that which may be visualized as a positive quantity flowing to or being consumed in an inductive circuit and conversely flowing from or being produced by a capacitive circuit. Thus reactive power is consumed by any electrical device which requires magnetizing current, such as induction motors, transformers, etc. It is produced by increasing the field excitation of generators or synchronous condensers, and by static capacitors or the static capacitance of transmission lines.

Simplification can then be obtained by measuring reactive power as "in" or "out" similar to active power being measured as "in" or "out." If, by convention, kilowatts "in" are those consumed and kilowatts "out" are those produced, the same convention may be used for kilovar flow, i.e., kilovars "in" are those consumed and kilovars "out" are those produced. It must be recognized that the direction of kilowatts or active power flow can reverse without necessarily affecting the direction of kilovars or reactive power flow.

This nomenclature and concept of independent components of power have been found advantageous and are being used extensively in connection with network calculator studies to designate diagrammatically by

arrows and in tabulations by plus and minus signs, the "in" and "out" directions of kilowatts and magnetizing kilovars in relation to the various loading points. Application of this convention to system metering should be equally advantageous.

Reactive Power Measurement

The value of reactive power is given in vars when the effective current is in amperes and the effective potential difference is in volts. Var measurement is obtained by applying to a meter a voltage that is in quadrature to or is displaced by 90 deg. from the voltage normally used for watt measurement. It is recognized that with use of the practicable methods of obtaining this quadrature voltage, accurate measurement is predicated on the assumption that the circuit has balanced voltages. Voltages are in general sufficiently balanced to provide the requisite degree of accuracy by this method.

The type of metering equipment used to measure the reactive component of power varies depending upon the kind of measurement which is desired. It may consist of (1) modified indicating or graphic wattmeters for instantaneous values, (2) modified indicating or graphic thermal watt demand meters for average demands, (3) demand registers, indicating or graphic demand meters for average demands, the basic measuring element of which is a modified watthour meter.

Zero Center Meters

Wattmeters of thermal watt-demand meters when properly connected with regard to the phase sequence of the circuit, to measure "out" vars or vars which are produced, will tend to give a negative indication if the direction of reactive power changes or if the phase sequence is reversed. They can be designed for zero center scales or zero center strip charts and one meter can be used to measure kilovars and one meter to measure kilowatts.

Zero center scales or charts may be marked "in" on the lefthand side and "out" on the right-hand side. This method of marking will permit the direction of scale or chart deflection to be the same as the diagrammatic direction of flow of either active or reactive power in relation to the metering point.

Referring to Fig. 3, when the direction of kilowatt or kilovar flow is to the left or into the metering points as from B to A, the meter deflection is to the left; when the direction of kilowatt or kilovar flow is to the right or out of the metering point as from A to B, the meter deflection is to the right.

Similarly in Fig. 4, where metering points are established at both systems A and B, meter deflection to the right indicates power flowing out of either system and meter deflection to the left indicates power flowing into either system. Or, in other words, up scale readings will always represent active or reactive power delivered from and down scale readings active or reactive power received by the system.

Generators and Synchronous Condensers

Referring to Figures 5 and 6, this conformity between direction of scale deflection and diagrammatic direction of power flow has an additional advantage for kilovar measurement at generator and synchronous condenser terminals. With a generator meter upscale readings (normal meter deflection) indicate normal operation and down-scale readings show that the generator is being operated under abnormal conditions. With a synchron-

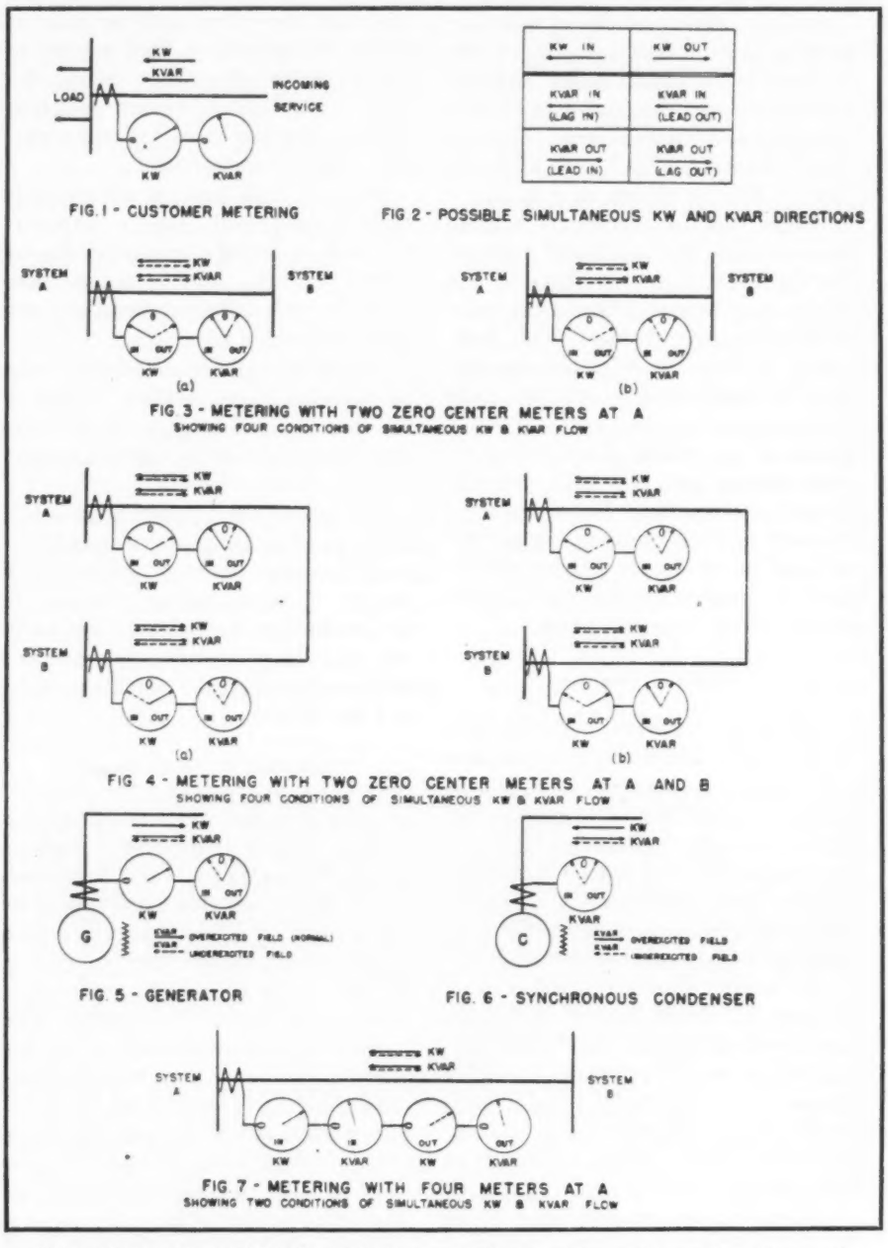


FIG. 1 - CUSTOMER METERING

FIG 2 - POSSIBLE SIMULTANEOUS KW AND KVAR DIRECTIONS

FIG 3 - METERING WITH TWO ZERO CENTER METERS AT A
SHOWING FOUR CONDITIONS OF SIMULTANEOUS KW & KVAR FLOW

FIG 4 - METERING WITH TWO ZERO CENTER METERS AT A AND B
SHOWING FOUR CONDITIONS OF SIMULTANEOUS KW & KVAR FLOW

FIG. 5 - GENERATOR

FIG. 6 - SYNCHRONOUS CONDENSER

FIG 7 - METERING WITH FOUR METERS AT A
SHOWING TWO CONDITIONS OF SIMULTANEOUS KW & KVAR FLOW

"IN" AND "OUT" NOMENCLATURE proposed for active and reactive flow and metering includes zero-center and separate meters

ous condenser meter, the direction of scale deflection clearly indicates whether the machine is producing or consuming reactive power.

Separate Meters

A watthour meter when properly connected with regard to the phase sequence of the circuit, to measure "out" varhours or varhours which are delivered, will rotate backwards if the direction of reactive power changes or if the phase sequence is reversed. Demand registers or demand meters which are operated from a watthour meter do not function with reversed rotation of the watthour meter and it is necessary to ratchet the meter to prevent reversed rotation. Therefore, with this type of metering equipment it is necessary to provide a separate watthour meter and demand device for measurement of each quantity, i.e., kilovars "in," kilovars "out," kilowatts "in," and kilowatts "out." This is shown in Fig. 7.

Where separate meters are used to measure each "in" and "out" quantity the direction of scale deflection can not be coordinated with the diagrammatic direction of power flow. Indicating or strip chart meters conventionally move up scale or to the right when measuring load and the record produced by round chart meters or printometers can not have any left or right designation. Reference must be made to the meter marking as "in" or "out" to determine whether the active or reactive power flow is into or out of the metering point.

Uniform Practice

Adoption of uniform metering such as has been outlined gives complete information on reactive power flow in a manner similar to that obtained for active power flow. Meter readings can be interpreted in a standard manner whether measurement is on a generator, synchronous condenser, tie line, interconnection or customer load.

While the discussion refers particularly to meters located at the metering points, the same "in" and "out" nomenclature for active and reactive power metering can be used with equal advantage in the designation of these quantities when totalized or telemetered. Also it can be applied to kilowatt-hour readings and it can be applied to kilovar-hour readings if this type of metering is used.

The Promise of Arc Welding

Improvements in electric arc welding techniques, tremendously accelerated by the necessities of war production, will have profound effect in many apparently unrelated fields when the war is over, according to W. J. Conley of the Lincoln Electric Co. in a conference paper presented at the recent mid-winter meeting of the American Institute of Electrical Engineers.

Welded pipe lines and pressure vessels used in the petroleum industry fortell the time when all boilers will be welded, including those of locomotives. Improved gasoline made possible by better refining through the use of welded equipment and operating at higher temperatures and pressures will influence automobile engine design. Thus lighter, higher powered, more economical units will make possible better transportation.

Aviation will have a correspondingly large growth. Rail transportation will be greatly improved due to light, welded, alloy-steel coaches drawn by more efficient diesel engines made by welded fabrication.

The whole agricultural picture may be changed since welding makes it possible to build large, portable food processing units which can be brought to the locations of crops.

It is not beyond practical possibility to produce in quantities prefabricated housing units of welded steel sheets. Thus, houses may come off the production line with all the heating, plumbing, electrical connections, and trim installed for quick assembly in a few hours.

Increased Welding Speed

The particular improvement in arc welding that has so greatly speeded up war production and that holds out so much promise for post-war is itself a speeding up. It was found that faster movement of the arc along the line of joining made more energy available to melt the base metal. The result was a greater actual fusing together of the joined pieces and a lessened piling up of metal from the welding rod. Of two welds joining pieces of $\frac{1}{2}$-in. plate, both made with $\frac{1}{4}$-in. welding rod, one has a strength of 27,000 lb. per lineal inch, the other a strength of 32,000 lb. The first weld was made with a 300-amp. arc moving at 5 in. per min; the second with a 350-amp. arc moving at a 12-in. rate. The difference between the two welds represents a saving of 50 percent in metal deposited from the welding rod, 50 percent less labor time, 40 percent less cost and 25 percent more strength for the second weld.

With the use of heavier currents and the application of welding to more complicated designs, arc blow became troublesome for some applications using direct current. This was minimized by the use of alternating current, made possible by a great improvement in electrodes. The demand for welding generators exceeded the capacity of the direct current equipment manufacturers while the facilities for making alternating current transformers could be quickly enlarged. This created a great impetus for the use of alternating current, causing a rapid development in that direction.

Automatic Welding

With the advent of engineering control and the associated better fitup facilities for handling weldments to position them for flat welding, engineers began to think of automatic welding. Designers planned joints with as long continuous welds as possible and continuous handling devices were made to feed material to the automatic arc, or the welding head was mounted so as to travel along the joint. By this method, much larger currents were possible than by means of manual welding. A method was devised to keep the arc completely covered by flux so that speed was not a function of the ability of slag to form and cover the metal since the flux was deposited on the joint or plate ahead of the arc as fast as it could travel consistent with the conditions. The larger currents made possible much higher melt-off rates so that larger V-joints could be filled with a single pass. Without excessive buildup, a plate up to $1\frac{1}{4}$ in. could be joined by two passes, using a square butt preparation. On applications where the automatic could be kept working a large percentage of the time, cost dropped drastically and speed skyrocketed. Thus $\frac{1}{8}$-in. sheets can be butt welded 100 percent at speeds as high as 120 in. per minute.

Gets More for Money with Mercury Lamps

Lower installation and operation costs are realized in Denver with mercury street lighting Color is not objectionable

GEORGE E. CRANMER*, Denver, Colorado

THROUGH widespread use of mercury lighting on its business streets, the City of Denver has obtained two gratifying results—public approval and lower maintenance cost. All this was accomplished through gradual experiments and good teamwork on the part of utility and municipality.

In 1936 the property owners on a semi-business street equipped with iron trolley poles proposed to pay for the installation of a light on each pole if the City would pay for the electricity. The City thought the maintenance of such a system might prove too costly and requested the Public Service Co. of Colorado to have a new unit designed which would require only half as many fixtures with more lumens per unit.

As a result, the following year we tried out the new 400-watt Mazda H mercury lamp, combined with incandescent lamps, on a street which had just been widened. The luminaire was a G-E Form 81, made of aluminum and with an aluminum reflector.

The public accepted the mercury lighting at once, and it was found that the new source gave more than twice the light for a given cost. We further found that the appearance of foliage was enhanced and that, notwithstanding very low winter temperatures, no difficulty was experienced with lamp starting.

Impressed with the glare reduction and visibility improvement resulting from this new installation, we experimented with mounting heights even higher than the 26-ft. one we had used. We found, through the use of two 50-ft. poles which allowed height variation from 10 to 50 ft., that glare was reduced as height was increased. Visibility increased up to 30 ft., above which it tapered off. We decided on 30 ft., therefore, as the most desirable height for the 16,000-lumen mercury vapor lamp we planned to try next.

Another Denver street needed more light, so we installed these lamps, equipped with Alzak aluminum reflectors. This was the first time 400-watt mercury lamps were ever used without a counterbalancing incandescent.

Use of the mercury lamp alone, we found, reduced operation expenses through a reduction in current required. As a result, we removed all of the incandescents from our Form 81 luminaires and used the mercury lamps alone.

About that time General Electric adapted a light-weight lower-cost luminaire called the Form 79 to use with the mercury lamp. With an aluminum reflector and die-cast aluminum hood, this light-weight unit which weighs roughly one-half that of the Form 81, imposed less strain and demands on pole and bracket construction, and we proceeded to install some with very good results.

To confirm our belief in this new luminaire and in preparation for its more widespread use, we made 10,000 night-time observations with the aid of a street lighting evaluator. Our findings resulted in a modernization plan for several downtown streets, which Mr. Gaylord Buck, vice-president of the utility, and I presented to Mayor Stapleton who approved it.

We now proceeded to change our business streets over to straight mercury as rapidly as possible. Though there had been some dubiousness concerning the bluish color for the central shopping district, we found that this actually presented no problem. Light from a mercury lamp contains no red, but incandescent store window lighting and red neon signs offset this giving a satisfactory color quality.

We next tried mercury lighting in one of our parks. Removing fifty-eight elaborate upright standards with numerous globes from the Civic Center, we replaced them with only eight 16,000 lumen pendant-type mercury luminaires installed fairly high.

All in all, mercury lighting has proved so successful in Denver that as soon as war conditions permit we will complete the renovation of street lighting. At present we have installed 934 luminaires, the largest single mercury installation in the country. About 70 percent of our downtown area is lighted with mercury.

Both the City and the operating utility are convinced that the new mercury lighting system affords a higher level of illumination and visibility per dollar of both initial and maintenance cost compared with the incandescent system employed previously.

DENVER BUSINESS STREET lighted with mercury-incandescent luminaires mounted 23-ft. 6-in. high in staggered 90-ft. spacing

*Manager of Improvements and Parks

Editorials

S. B. WILLIAMS, *Editor*

Inferences Drawn from Aubrey Williams Defeat

WHAT INFERENCES, if any, can be drawn from the refusal of the Senate to give approval to the appointment of Aubrey Williams as REA Administrator? All kinds of deductions have been made by columnists to show political trends, but we are more concerned with the effect upon future REA activities.

In none of the deliberations was rural electrification or the lending agency on trial. The Senate made it rather plain it was considering only the man when it showed little interest in the proposal that consideration be given to returning REA to independent agency status before taking up the appointment. In fact, the stir created by the appointment is some evidence of the importance that the Senate attached to rural electrification and REA.

If the agency had been a small one and the funds at its disposal not very large it is doubtful if the appointment would have drawn as much attention either inside or outside the Senate.

This is the second time that the Senate has balked over the appointment of an inexperienced man to administer the spending of large sums of money. It may be assumed then that anyone who gets the REA post shall have a successful background either in business or farming or as an administrator. Also, this is the third time that the Senate has challenged the color of an appointee's political, social and economic philosophies, which might be some indication that the Senate is becoming less interested in idealism and theory and more interested in the practical matter of getting the job done properly.

Taking these together the further inference can be drawn that the Senate will do all it can to remove REA from politics although Williams, in defeat, claims he will make it more of a political target. Whether Senate action can be taken as an indication that REA will get independent agency status soon is highly speculative in view of the more important things that will be demanding attention.

However, by placing emphasis on practical management the Senate action might have the effect of encouraging rural electrification for its own sake and not for the sake of extending public ownership or fighting the utilities. The REA movement could have gone ahead a lot faster had it not consorted with a group whose interest was anti-utility. Had the Senate been in accord with that program it is doubtful if it would have turned Williams down.

If rural electrification is to grow, not alone in numbers of customers but in expanding usage with all the speed that it should, then the co-ops and the utilities must work more closely together.

REA needs utility cooperation more and more as it moves into thinner territory. In low density areas farm house usage must be greatly supplemented with farmstead usage if the lines are to pay out even at the lower interest rates. This is a job that must have constant attention by a specialist and these are in the employ of the utilities.

Another Reason for Clarifying Amendment of Federal Power Act

NOTHING that we have seen more clearly demonstrates the need for an amendment of the Federal Power Act to clarify the limits of federal regulation than the ruling handed down this week by the Supreme Court of the United States reversing the lower court in the Connecticut Light & Power case and remanding it to the Federal Power Commission. The peculiar circumstances of the case, according to the Commission, occur only infrequently so that only a small fraction of one percent of the utilities will be directly affected by its outcome one way or the other.

On the other hand, the decision can be far-reaching for, aside from pointing out the looseness with which the Act was drawn, it distinguishes between local distribution and transmission in a simple, understandable way without trying to trace the meanderings of a kilowatt-hour, and more importantly it should be a check to the propensity of FPC to disregard limitations of the law that interfere with its regulatory desires.

The Connecticut company to escape the jurisdiction of FPC had severed all of its outside ties, or so it thought, but it still was purchasing energy from another state which was delivered to its Bristol substation. The Commission claimed that accounting jurisdiction could not be evaded by stopping the sale of energy across state lines and also sought authority on the grounds that the company's substation to which foreign energy was shipped was an element of transmission.

The Court paid little or no attention to what-used-to-be-but-not-now-is claims and on the present grounds asked whether or not the substation might not be construed as operating in the distribution circuit. This is another of those "which came first, the hen or the egg" situations that some people try very learnedly to solve

by higher mathematics and ultra-technical reasoning but which in the long run is generally best solved by just plain horse sense. What is it used for? To distribute or transmit? We wonder if FPC would find companies trying to escape from its jurisdiction if its approach were more in this straightforward manner.

Part of FPC's more expansive interpretation of the Act can undoubtedly be attributed to the Supreme Court's Jersey Central decision which the lower court in the present case held was authority for the Commission's action. It was interesting to see the chickens coming home to roost and the painstaking way in which the court set about to interpret its own earlier decision. If the court makes enough interpretations of that famous decision it may restore to the Act the powers and limitations its authors had thought they were putting into it. The better way, however, will be to accept the fact that legislation is a function not of courts or agencies but of Congress. If acts are uncertain and loose the correction should be by amendment.

Wind Power

THE FORCE OF THE WIND which for scores of years has been in comparative disfavor for propulsion and for power purposes, because steam is so much faster for getting places over the seas and electricity is doing more of the work on more of the farms of the world, appears now to be having a resurrection.

In different parts of the world the wind turbine is arousing more and more interest in the range of large capacities (thousands of kilowatts) and is attracting the attention of well known engineers and institutions. There are two or three good reasons for the revival.

First, the airplane has resulted in extracting from the air a knowledge that is a double-edged cleaver. It tells us what can be done effectively when revolving blades are used to spiral their way through the atmosphere and also what effective torque can be gotten when the moving atmosphere revolves the blades. Second, the need for information about upper air movements and conditions has impelled the study of meteorology quite detached from the surface film that was the limited field of observation before aviation. That knowledge, scant as it is, tells us there is virtue in going well above the surface if we want sustained velocity. Third, we are becoming gradually more conscious that the best of the oil deposits and the best of the hydro sites have been developed and that even coal will not last forever.

The Grandpa's Knob experiment is one significant jump into the higher brackets—and it is producing. The Russians some day may release some information about their installations and projected designs. There will be other approaches and there may be considerable fumbling but there should be progress in utilizing another of the incessant and practically inexhaustible forces of nature for generating electricity.

War Time and Tired Machines

MACHINES get tired just as do men after day after day of unrelenting pressure, and now some of this fatigue is showing up in unscheduled outages. Perhaps if there were a larger maintenance force of capable men this problem could be lessened to some degree but with further reductions in draft age manpower no improvement can be expected.

That is one of the reasons, if not the most important, for keeping war time in spite of the demand for its removal from so many sections of the country. Even though the daylight hours are growing longer and the peaks are coming down, the dependable reserve in certain areas is too low to take the chance of adding more kilowatts through a change in time.

Last fall it looked as though war time could be abandoned this spring and it might have been were it not for this growing amount of unscheduled overhaul due to machine fatigue primarily and to the unsettled coal production situation.

During the past few weeks representatives of OWU have been kept busy trying to convince state legislatures that war time is no hair-shirt measure but is necessary. People should be urged to bear with it until this emergency is passed, which can't be very long.

Permission to build new machines won't help very much at this time because by the time they were ready this necessity would have passed. People must, therefore, be urged to have patience for one more summer, after which, it is hoped, conditions may be such that some of these civilian restrictions can be lifted.

Beware the "In-and-Outer"

UNLIKE MOST OTHER RETAIL TRANSACTIONS, which included only two parties in interest, the buyer and the seller, the purchase of an electric appliance is the concern also of a third, the electric utility.

The purchaser chose the particular appliance in preference to others of its kind and was, presumably, influenced in its selection by advertising and other forms of selling. Although the final decision to buy may have been made on appearance or some other feature of appeal, yet the purchase was made, not because the appliance was just to be owned and looked at, but because it was to be used. And if the appliance does not deliver full measure of use, then the buyer was cheated.

It is to be expected that the promise of an impatiently waiting market will attract to the business of making and selling electric appliances a certain number of people more enterprising than reliable, the in-and-outers. Foreseeing this condition, it behooves the third party in interest in the purchase of an electric appliance, the electric utility, to be prepared and ready to protect the purchaser against inferior products and deceptive sales methods.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Williams' Defeat May Bring New REA Troubles

THE PROSPECTS of additional confusion in the entire REA situation were strengthened considerably by last week's bitter Senate debate culminating in a 52-36 defeat for Aubrey Williams.

REA's internal situation has not been good for some years. The fact that last year's Senate Investigating Committee could spend six months plowing that field without completing the job is ample proof of REA's internal unrest. The agency has been without an Administrator for almost four months. It is true that neither the internal unrest nor the absence of an Administrator has prevented REA from doing an effective job of continuing to bring electric service to unserved farmers. But the fact that the agency has been able to move forward, even though hobbled, is a doubtful excuse for retaining the hobbles.

Hearings on Political Basis

REA, according to law and to the protestations of Congressmen, is supposed first and foremost to be non-political. That concept, if it ever was honored at the Capitol, was pretty thoroughly dishonored throughout the Williams affair.

It would be supposed, for example, that Senators who believed in a non-political existence for REA would have conducted the hearings into Williams' qualifications for the administratorship on a non-political basis. Those hearings, dealing as they did mainly with Communism and the value or worthlessness of the defunct NYA, were about as non-political as an early November torchlight parade.

The debate, which saw pro-Williams Senators harangue an empty Senate hour after hour for five days was also non-political—although not very.

The campaign which Williams' non-Congressional supports waged in his behalf was hardly less political than that waged against him. Granting that one way of fighting fire is with fire, the "Friends of Aubrey Williams" Committee, which properly decried Sen. Bilbo's interjection of the race equality issue, exerted political pressure of its own into an allegedly non-political matter when it bought advertising space to charge that a vote against Williams would be a vote for "racial and religious bigotry" and a vote to put the "welfare of the small farmer above the self-interest of absentee landlords and private power companies."

First Battle in Total War

Williams, himself, after putting on a much more edifying performance than his opponents throughout the entire tussle, changed character after the vote had been taken. Williams then joined his boss, President James Patton, of the National Farmers Union, in a post-defeat statement that the whole matter was "the first battle in a total war of issues to decide whether the country is to be conducted for the people or for the vested interest. "The Farmers Union people," Patton promised, "will become much more intense in their feelings because of Mr. Williams' rejection. We are going to take whatever steps are necessary to implement our feeling more drastically . . . We'll be seeing some of these Senators out where the people live."

Both men indicated that Williams' defeat would signal the opening of an intensive national organizing and political campaign, aimed principally at the South, by the Farmers Union.

The idea of concerted political action to install in office those men believed to be best fitted for office is, of course, as American as the Declaration of Independence, regardless of the wealth or the poverty of the campaigning group.

The Patton-Williams program, however, tied by its authors directly to the REA-administratorship fight, hardly jibes with the non-political aspects with which Congress attempted to clothe REA. Anyone who took such a tossing-around as Williams has in the past month is entitled to some hard feelings toward his attackers. But Williams, who in sworn testimony before its Agriculture Committee, told the Senate that he would if confirmed, uphold the REA Act and its anti-politics provision to the best of his ability, apparently feels that his defeat frees him from the necessity of supporting further REA's non-political position.

Thus REA, which so far has had its troubles with the pro-Craig-anti-Craig factions, the pro-NRECA-anti-NRECA struggle, the pro-Slattery-anti-Slattery argument, and the pro-independence-anti-independence quarrel, must now batten down its hatches for the heavy weather threatened by Patton and Williams through NFU.

One look at the line-up of farm state Senators who opposed Williams suggests that NFU's threats of political reprisal are somewhat less appalling than similar threats by other farm organizations might be. Still, NRECA, which is no political heavyweights, was, whether fairly or unfairly, the peg on which one Senate investigation of REA was hung.

REA's Program

How long REA will be able to continue its job of bringing electric service to farmers while the tempest intensifies around its head remains to be seen. For whatever reason, REA is now and for months has been connecting most of the farms that are being connected. It is following the war surplus property declarations closely by sending men to all regional Defense Plant Corporation offices. Co-ops have bought impressive amounts of wire and cable, and pole line hardware. REA itself has laid out a three-year post-war construction program and has the legislation to finance it before Congress and in position for action reasonably soon. A policy on wholesale power contracts aimed at lowering operating costs has been invoked by REA, backed by the tacit threat of increased self-generation.

REA is doing a good deal better for itself than its "Best Friends" are.

NEWS OF THE WEEK

Supreme Court Decision Favors State Regulation

Rules in Connecticut Light & Power Case That Ownership of Electric Power Facilities Used for Local Distribution Does Not Subject Company to FPC Jurisdiction—Several Specific Issues Left Undecided

Ownership of electric power facilities used for local distribution does not subject the owning company to jurisdiction of the Federal Power Commission even though the lines may carry energy which has been transmitted in interstate commerce, the Supreme Court ruled this week.

The ruling came in a 6-3 decision under which the High Court reversed a circuit court decision sustaining an FPC order which held the Connecticut Light & Power Co. to be a "public utility" under the terms of the Federal Power Act. The case was remanded to FPC "for further proceedings consistent with this opinion."

While the majority opinion, prepared by Mr. Justice Jackson, was not a final defeat for FPC on the issue, it appeared to be a severe blow to FPC's standards for determining whether it has jurisdiction over an otherwise intrastate power company, and it represented a substantial, if not an entirely clear-cut victory for state regulation.

Mr. Justice Murphy, joined by Justices Black and Reed, dissented, holding that FPC would merely have to make technical corrections in the form of its order to make it stick.

The High Court declined to determine several specific issues in the case, among them the following:

1. Whether the C.L.&P.-owned facilities in question are facilities subjecting the company to the Federal Power Act.

2. Whether, if the facilities in question are not "interstate transmission facilities," the company must retroactively be subject to FPC accounting controls because of previous ownership of "interstate transmission facilities," even though it be not now a "public utility."

The case was argued on whether C.L.&P. ownership of a substation at Bristol, Conn., through which passed for local distribution alone, energy generated in Massachusetts, rendered C.L.&P. a "public utility" under the Federal Power Act. The company had cut numerous other ties to render its business a purely intrastate one.

In reversing the circuit court, the majority emphasized the purely local and intrastate character of C.L.&P. It held that the court below misapplied the Jersey Central Power & Light decision, and pointed out that the price of the Massachusetts energy could be regulated before the energy ever reached C.L.&P., thus enabling the fulfillment of the purposes of the Federal Power Act.

The court held that the policy declaration of the Federal Power Act, which states that the act is not intended in any way to diminish local regulatory authority, "cannot be wholly ignored."

"The assurance which the sponsors of this legislation expressed as to protection of the general jurisdiction of a state over electric utilities of this character either is not given effect by this act at all, or it is to be found in the words of Paragraph 201 (b), "but shall not have jurisdiction, except as specifically provided in this part or the part next following, . . . over facilities used in local distribution . . ." The majority opinion declared, adding:

Congress Expressed Its Wishes

"It is hard for us to believe that Congress meant us to read "shall have jurisdiction" when it had carefully written "but shall not have jurisdiction."

This clause, the opinion held, ". . . is one which the commission must observe and the courts must enforce."

The court declared that by the FPC's test, ". . . the cord from a light plug to a toaster . . . is a facility for transmission of interstate energy if any part of the load is generated without the state."

Such construction of the law, the court went on, might be "quite unobjectionable and perhaps highly salutary" if no state governments existed "and the only conflicting interests to be considered were those of the regulated company."

But Congress, the opinion continued, ". . . sometimes is moved to respect state rights and local institutions even when some degree of efficiency of a federal plan is thereby sacrificed."

"We hold the phrase, the "but" clause of Paragraph 201 (b), to be a limitation on jurisdiction and a legal standard that must be given effect in this case in addition to the technological test."

1944 Utility Tax Bill Rose to $703,000,000

Business-managed electric utilities paid a $703,000,000 tax bill in 1944, C. W. Kellogg, president of Edison Electric Institute, has revealed. The increase over 1943 was $23,000,000.

Of the $2,955,000,000 gross revenues of the utilities, the federal government collected 15.84 percent or $468,000,000 in taxes. State and local governments took an additional 7.95 percent aggregating $235,000,000. Combined taxes on the industry took 23.79 percent of gross revenues.

The federal taxes included $55,000,000 for the 3 percent excise tax (residential and commercial), $12,000,000 miscellaneous, and $401,000,000 on income.

Arguing that the exemption of facilities used for local distribution only does not apply solely to those facilities on which no interstate energy ever flows, the court asserted:

"It does not seem important whether out-of-state energy gets into local distribution facilities. They may carry no energy except extra-state energy and still be exempt under the act. The test is whether they are local distribution facilities. . . . The order must stand or fall on whether this company owned facilities that were used in transmission of interstate power and which were not facilities used in local distribution."

The court held that FPC had not made an explicit finding that the facilities in question were not used in local distribution and added that ". . . we are in doubt whether by application of the statute as herein construed it could have done so. . . . The findings and opinion of the commission leave us in doubt. . . as to whether what we consider limitations on the jurisdiction of the commission were so considered by it."

In reconsidering its order, FPC will be expected to consider the "but" clause in the light of the court's construction thereof.

The minority opinion declared that FPC's order showed "proper respect for jurisdictional limitations," and added that:

"Remand of the case to the commission for further consideration thus can only serve to produce needless delay and to force the commission to make certain minor and unnecessary changes in its written opinion."

"The commission clearly did not misconceive the meaning of this policy declaration," the minority declared, "and, in the light of this court's opinion, it apparently need do no more than spell out its recognition of the scope and present inapplicability of the declaration . . . the denial of jurisdiction in the "but" clause where facilities are used for transmission of energy in local commerce has no relevance in this case, an obvious fact which the commission apparently must now make explicit on remand."

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Bryan on Wisconsin PSC

Samuel Bryan, examiner for the Wisconsin Public Service Commission, has been appointed to the commission to succeed R. W. Peterson who resigned recently. His term will expire in 1951. Lynn H. Ashley has been chosen chairman of the commission to serve Peterson's unexpired term. A chairman for the new term must still be elected.

Interior Department to Get First Surplus Equipment

OWU Will Recommend That 35,000-Kw. Steam Turbine and Boiler, Now Inactive at Magnesium Plant at Lake Charles, La., Be Transferred to Lake Catherine, Ark.,—Equipment Sought by Private Utility

The first problem involving the disposition of war surplus electric generating equipment is expected to be settled shortly by an Office of War Utilities recommendation to the Defense Plant Corporation that it transfer to the Interior Department a 35,000-kw. steam turbine and boiler, now inactive at the federally owned magnesium plant at Lake Charles, La.

Interior has been seeking the unit for installation in the Lake Catherine, Ark., generating station now operating in conjunction with a federally owned aluminum plant there. At least one privately owned electric company has attempted to obtain control of the unit by lease with an option to purchase. The machine, about 95 percent completed, would cost more than $200,000 to complete and would not be in operation at Lake Catherine in less than six months.

Unit Transfer Will Speed Service

Basis for the decision in favor of Interior, which OWU had not actually transmitted early this week, was the existence of a power supply deficiency in the Arkansas area now and the apparent fact that the Lake Charles unit can be in operation at least a year earlier than a new unit could be installed in the region otherwise. In addition, the projected transfer would require considerably less manpower and critical materials, OWU Director Edward Falck pointed out.

Arkansas Power & Light Co. has asked OWU for authorization for a new unit of about the same size. Falck emphasized that even if the Lake Charles unit goes to Lake Catherine, A.P.& L.'s request may very well be granted. Reserves in the area are now about 70,000 kw., it was learned, and some capacity normally considered to be reserve is in use.

No information on terms of the Lake Charles transfer was immediately available nor was there any indication of whether the existing Lake Catherine station had been turned over to Interior by DPC.

Interior has two over-riding claims to surplus generating equipment. One is contained in the Surplus Property Act, which became law last fall, providing that inter-agency transfers of surplus equipment shall have precedence over other sales or transfers. The act actually goes further, to provide that federal agencies must fill their needs from surplus wherever possible, and that the Surplus Property Board must see that they do so.

The other over-riding claim is based on a Presidential statement of late 1943 that war-born generating capacity no longer needed for war purposes should be incorporated in existing public power system wherever feasible. While this statement has no legal standing, it is, as an Administrative measure, binding on agencies under the control of the Administration, of which the Defense Plant Corporation is one.

Gulf States Utilities Co., now receiving energy from the Lake Charles plant under a contract for 22,000 kw., has attempted to lease the unit in question. Gulf is being supplied from the output of eight 7,500-kw. and one 15,000-kw. machine. Three of the smaller units, without boilers, are more or less firmly committed to the Dutch, who want them for pumping out inundated sections of the Netherlands. The Army has asked for five boilers to be installed elsewhere in industrial stations, and Interior has asked for one 7,500-kw. machine for installation in an undisclosed station in Montana. It will be necessary to retain three 7,500-kw. units or one 7,500-kw. machine and the 15,000-kw unit at Lake Charles to fill the Gulf States contract.

The 35,000-kw. machine originally was intended for Lake Catherine, where foundations and gas supply for its boiler already exist.

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Big River, N.S., Plant Opens

A new coal burning generating plant has been completed at Big River, N. S., for the Nova Scotia Power Commission. Two 400-hp. Vickers boilers will supply steam. Capacity is 1,500 hp. Coal consumption will be about 15 tons daily instead of 100 tons used in the old plant.

F. H. Tremaine, commission engineer, supervised the construction, and James Russell will be in charge of the plant as chief operator.

Senate Awaits Candidate for Administrator of REA

Consensus Is That Rejection of Williams Will Lead President to Nominate Man Who Can Easily Be Confirmed—Former Senator Gillette and Douglas Wright, Southwestern Power Administration, Possibilities

The Senate has the whole process of confirming an administrator of the Rural Electrification Administration to go through again after its rejection of Aubrey Williams, but consensus of the speculation early this week was that the forthcoming nominee would be a man on whom the Senate could agree without much difficulty.

There was no immediate indication of how soon the President would transmit another nomination for the $10,000-a-year position. It was widely felt, however, that the nomination might come soon and that it would be one aimed at settling the whole matter with a minimum of further disturbance.

The name of former Sen. Guy M. Gillette, of Iowa, now chairman of the Surplus Property Board, was frequently cited as an example of the type of nomination which would command enthusiastic Senate approval. Gillette was confirmed without question, and his prestige with the Senate helped swing confirmation of his two SPA colleagues, to whom a considerable amount of objection was raised.

There was no indication of whether the President would look for a well-known figure to head the agency or whether he would delve into the Government's pool of power officials for a man less widely known but one whose experience has been such as to soothe those who held Williams unqualified.

Has Public Power Background

In the event the President chooses the latter course, there was some speculation on the name of Douglas Wright, manager of the Southwestern Power Administration of the Interior Department. Wright has the requisite public power background, a technical education obtained at the U. S. Naval Academy, and substantial experience in power system management both under Interior and the Federal Works Administration. Although he is probably not so well known as was Harry Slattery when the latter was appointed REA Administrator, Wright has received ungrudging praise from several congressmen as a result of his appearances before appropriations subcommittees.

Williams failed of confirmation after four and one-half days of Senate debate, all of it of the same pattern—high praise or strong denunciation of the nominee. The vote—52-36 against confirmation—surprised many observers who had expected an extremely close margin. It was almost precisely proportional to the vote by which the Agriculture Committee decided to report the nomination adversely. Once again the Republican-Southern Democrat coalition proved capable of defeating the administration on a home-front issue antagonistic to conservatives.

Following his defeat, Williams joined with President James F. Patton of the National Farmers Union, most liberal and least powerful of the three major farm organizations, to castigate those who brought about his defeat. Patton called for political vengeance of those senators who opposed Williams and threatened to "see them out where the people live." Williams' defeat, Patton said in announcing an organizational and political drive among unorganized farmers, particularly in the South, was the "first battle in a total war of issues to decide whether the country is to be conducted for the people or for the vested interests."

With the Williams nomination out of the way, the Senate had before it the Agriculture appropriation bill for the fiscal year ending June 30, 1946, in which loan fund authorizations for the Rural Electrification Administration were boosted to $60,000,000 or more than double those approved for the present fiscal year. The bill passed the House smoothly after an amendment by Rep. John Rankin, Mississippi Democrat, which would have authorized loan funds totaling $150,000,000 for fiscal 1946, was defeated.

Introduced in the House with bipartisan sponsorship were identical bills which would allow the Bonneville Power Administration to settle claims without going through cumbersome federal practice, and which would allow BPA to deal with labor organizations. The bills, introduced by Reps. Henry M. Jackson, Washington Democrat, and Homer D. Angell, Oregon Republican, contain the non-controversial provisions of the Bone Bill of several sessions ago, a highly controversial measure which never became law, but which would have established a Columbia Valley Authority.

The bills have the acquiescence of all privately owned power companies in the Northwest, but is not an administration bill.

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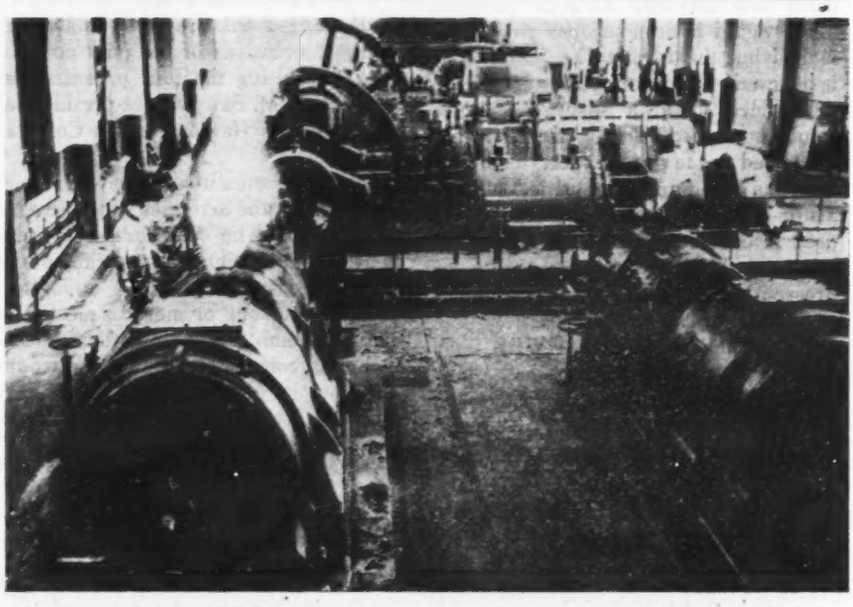
Danville, Va., Closes Plant

Danville, Va., which operates a hydroelectric plant, has shut down its steam plant. The city has a tie in with the Appalachian Electric Power Co.



GERMANS MAKE POWER FOR ALLIES—Two German workers are shown in the generating room of the Karl Alexander coal mine at Basweiler, in western Germany. The town, 12 miles northeast of Aachen, was captured last October by the U. S. First Army, and within three weeks, the German miners were back at work producing coal for the Allies

OWU Not Responsible for Enforcing Curfew

WPB and WMC Join in Enforcement of Byrnes Request with OWU Limited to Supplying Data

The Office of War Utilities will have no duties in conjunction with enforcement of the midnight curfew other than to furnish technical evidence and information pertaining to the use of various utilities when it is required for enforcement purposes.

This became apparent as WPB, on request of War Mobilizer James F. Brynes who "requested" the curfew, swung its weight behind the War Manpower Commission to which Byrnes assigned the job of enforcing the midnight closing of all but a restricted few public places. WMC is authorized to reduce the working force of violators to maintenance personnel only, and now has assurance of the cooperation of WPB in enforcing lowered manpower ceilings through the deprivation of violators (but only after investigation, hearing and finding of fact) of utility services, fuel and other materials or services controlled by WPB under its wartime priority and allocation powers.

Violators Will Lose Priorities

While no formal statement of WPB's participation in curfew enforcement was issued, it was understood that WMC would discuss with WPB cases of violators against whom it was expected to be necessary to invoke sanctions. If it become necessary for WPB to proceed, WPB would issue a priority regulation embodying the form to be followed, it is believed; and if sanctions were finally determined upon, a suspension order would be issued. OWU officials might be called in to give expert testimony as to the consumption of critical materials or services which were alleged to be used in contravention of the war effort, but it would have no responsibility for prosecuting any change or for issuing a suspension order.

It was believed that first WPB sanctions against violators would be to deny them WPB-controlled materials and services only for that period of the day when they actually were in violation of the curfew.

The plan for WPB participation in enforcement of the curfew was believed to be the best possible one, and was arrived at after some suggestions had been made that it be done by an amendment to order U-9, the brownout order, or by issuance of a U-10, which would have prohibited the use of utility facilities in contravention of the war effort. These suggestions, which would have laid impossible enforcement burdens on utilities, were discarded by the Byrnes office after WPB and OWU explained their defects.

WPB was the third federal agency to come to the rescue of the curfew after New York's Mayor F. H. LaGuardia shook the Byrnes "request" to its foundations two weeks ago by extending the curfew until 1 a. m. in New York City. First to come to Byrnes' aid was the Army, which ordered its personnel to observe the Byrnes limit of midnight. The Navy followed in New York, after which WPB worked out its plan of cooperation. Statements by WMC regional officials early in the curfew's history, to the effect that WPB would be directed by WMC to apply sanctions to recalcitrant operators of establishments subject to the curfew, caused considerable worry in Washington until the plan for WPB cooperation had been worked out. It was feared that any summary removal of utility service or other WPB sanction would run immediately into a court test, in which a decision adverse to the government could easily have killed the entire curfew program.

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Merger of 4 Associations Dropped for Coordination

There will be no immediate consolidation of the Edison Electric Institute, The Association of Edison Illuminating Companies, the Council of Electric Operating Companies, and the Advertising Group into a single organization.

This was revealed last week by C. W. Kellogg, E.E.I. president, in a report on the conclusions of the joint committee representing the four organizations of which H. M. Sawyer, vice-president of the American Gas & Electric Co., was chairman.

The joint committee, however, recommended that the activities of the several groups should be coordinated in order to avoid duplication and that each of the organizations be asked to appoint a committee of one or more to meet with similar committees of the other groups, including committees of any new groups not now in existence but which may later be formed, to recommend the nature of such coordination.

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Hacking Reelected in Utah

Donald Hacking has been confirmed by the Utah Senate for a second term as a member of the Business Regulation Commission which has control of public utilities in the state. His term will expire on March 1, 1947.

People Rise to Fight Army Potomac Plan

Residents of northern Virginia, western Maryland and eastern West Virginia plan to "march on Washington" next week to oppose "with every means at their command" an Army Engineer program for flood control and power development on the Potomac River and its tributaries which would entail 15 dams in the hilly Potomac head waters (ELECTRICAL WORLD, February 24, Page 4).

Based on opposition to the inundating of valuable lands and historic locations as well as to the destruction of numerous scenic "treasures," the demand that the project be junked was to be laid before a meeting of the Board of Engineers for Rivers and Harbors, which on April 3 will hold hearings on the project submitted recently by the District U. S. Engineer.

One opposition leader predicted that as many as 2,000 people would appear to protest the project, which the engineers estimate would be completed over a 20-year period at a cost of about $235,000,000.

Annual flood control benefits resulting from the project would be valued at $253,000, the District Engineers report states, or somewhat more than one-tenth of one percent of the total cost. Power revenues comprise the greatest part of the annual estimated benefits of $15,700,000, which outweigh estimated annual costs of $11,800,000.

Interior Secretary Harold L. Ickes, whose bailiwick includes numerous federally owned parks and other land tracts in the region, also was reported against the program, and was reported further to favor necessary future expansion of area power supply by construction of transmission lines to mine mouth steam plants in the bituminous fields of Virginia and West Virginia. Such a position is a notable departure from the normal Ickes contention that hydroelectric energy should be developed to the utmost with steam-generated energy reserved for necessary hydro backup.

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Kentucky Utilities Co. Gets Permits for Rural Lines

Kentucky Utilities Co. has been granted permits by the Kentucky Public Service Commission to construct 643.28 miles of lines to serve 3,923 customers. Authorization was given over a protest from the Clark County Rural Electric Cooperative Association which contended that portions of the proposed extensions were in territory that could be served better by it.

Use of Multipurpose Dams for Flood Control Deluding

C. N. Phillips, Ebasco Services, Tells Southeastern Electric Exchange That Power Pondage and Flood Storage Are Wholly Antagonistic Concepts—Engineering Meetings Termed Justifiable in Wartime by Mayott

Exposition of the fallacy in flood control by multipurpose dams and urges to build up reserves and to venture rather than hesitate were uppermost among the general topics on the program of the engineering and operation section of the Southeastern Electric Exchange in Atlanta, March 22 and 23. Technical papers covered determination of sub-transmission substation sizes, rural construction, costs and circuit protection on customers' premises. Attendance was 65 including 46 from outside the Atlanta area.

Flood control is an utter delusion where public power policy has obliterated the natural valley basins by installing the so-called dual purpose dams, said C. N. Phillips of Ebasco Services, Inc. Sacrifice of the valley storage areas provided by nature merely tends to accentuate the flood hazard by raising the crest and accelerating the run off. People below such dams have been lulled into an unjustified feeling of security, he said in showing diagrams exemplifying the principle that power pondage and flood storage are wholly antagonistic concepts. Manifest tendency among public power advocates is to encroach on the sound engineering recommendations for adequate flood control. Phillips cited an instance in which a dam exclusively for flood control (like the Miami Conservancy and Muskegon Valley projects) would have paid for itself in three years by avoidance of flood damage.

Meetings Aid War Effort

Utility engineering meetings are fully justified in wartime, said C. W. Mayott, formerly of the OWU staff of WPB, in so far as they continue to provide the information whereby the industry is enabled to continue its outstanding contributions to the war effort. Had the Olds' grandiose estimate of industrial peak and needed utility generating capacity prevailed over the accurate Bary prognostication, there never could have been the Navy that is now dooming Japan. Learning how to function with unbelievably small margins was a real achievement. But for the post-war era safer margins as to reserves, maintenance frequency and storeroom stocks will have to be the rule; Mayott said present tolerances are too scant to continue.

In giving a resume of apparatus progress, A. C. Monteith of Westinghouse Electric & Manufacturing Co. said there was still plenty to be done by both user and manufacturer in advancing the industry. He urged observance of Robert E. Lee's admonition that it is better to make mistakes by action rather than suffer in all respects by inaction.

Substation Size Advantages Given

Preponderance of high-voltage or low-voltage line costs in general determines the most advantageous sub-transmission substation size, said D. K. Blake of General Electric Co. in a paper adding to his well-known series on distribution economics. He pointed out that relatively large high-voltage line costs tend to favor large substations; multiples of the smaller sizes indicated by prepondance of low-voltage feeder cost would nevertheless afford the benefits of repetitive manufacture. In a tentative way, Blake expressed the conviction that few companies could justify more than two voltages, 69 and 13.8 kv. for concentrated load areas and 138 and 34.8 kv. for extended areas.

Six distribution engineers under the leadership of W. R. Doar, Carolina Power & Light Co., conducted a panel discussion of diverse problems of distribution. High points among the 22 topics canvassed were the following. Interest in a transformer load indicator is rising. Aluminum and galvanizing are vulnerable to salt sprays. Bethanized guys are durable but expensive. Arrester testing shows many to have abnormal leakage. The control of welder-service economics rests in a rate. Bulldozers do a lasting and inexpensive job of right-of-way clearing. There is call for a good all-around light source for night work. Creosoted pine arms are a money-saver. Steel pins are probably the ultimate answer to pin and arm burning. Increment boring does creosoted poles more harm than the good derived.

Mississippi Power & Light recently built 65 miles of rural line on 275-foot span (f.s. = 2) at about $957 per mile said J. W. Cavin, division manager. There are some 13 other miles of earth return circuit which appeared to save as high as one-quarter the cost of a metallic line. The company has a comprehensive promotional program and has plans for building a thousand miles on their $54 annual guarantee. Louisiana Power & Light guarantee is one-third this amount, also has some earth return but with neutral resumed in poor-ground stretches. In the discussion it was indicated that contractors who build "spite lines" for utilities have been summoned to REA headquarters to be informed they will be excluded from cooperative bidding.

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Hetch Hetchy Contracts Ready for Ickes' Approval

Taking another fling at evolution of Hetch Hetchy power sale contracts acceptable to Secretary Harold L. Ickes of the Interior Department, the city of San Francisco last week signed two new agreements which will be submitted for approval under terms of the Raker Act.

Both contracts, along with one to be completed with two Henry J. Kaiser companies, have nine-year lives and to be valid must have the stamp of approval of Secretary Ickes and Federal Judge Michael J. Roche before July 2, the recently extended effective date of an injunction prohibiting San Francisco from selling power to the Pacific Gas & Electric Co. for resale.

One contract, with the P.G.&E., provides that the private utility shall transmit all electric power needed for municipal requirements. Included in the agreement is a clause, inserted over P.G.&E. protest, giving the city the right to condemn the utility's distribution system and to expand Hetch Hetchy generating facilities at any time during the life of the contract. This would allow San Francisco to go into the power business if voters so desired, an enterprise advocated by Secretary Ickes.

The second contract, with the Modesto and Turlock Irrigation Districts, obligates the districts to construct all facilities necessary to transmit and transform power for their purposes.

Contracts with Kaiser's Permanente Metals Corp. and Permanente Cement Corp. were being prepared, it was reported.

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Dismantle Old Station

The Titusville substation of the Pennsylvania Electric Co., which at one time was the power station of the Titusville Light & Power Co., is being dismantled and the building will be used for storage.

Canadians Discuss Post-War Marketing

Electrical Association Learns of Developments in Rural Electrification by Private Utility Companies

Rural electrification plans and procedures and problems of marketing in the post-war period were studied at the western meeting of the Canadian Electrical Association, March 14, 15, and 16, at Vancouver. Attendance was 275.

Results of 18 surveys made in Alberta by the Canadian Utilities, Calgary Power Co., and the University of Alberta in the Province of Alberta show that the estimated cost per connection in these areas to be $575; based on 1942 prices and including transformers, meters, and services, E. G. Kelly, superintendent of construction for Canadian Utilities, said.

He explained how the two utilities set up three test areas to get definite information and data covering construction costs, suitability of various materials and equipment, operating experience, and operating costs. The projects have not yet been completed.

Must Sell Paying Appliances

J. Calder Munro, light and power sales manager, British Columbia Electric Railway Co., asserted "Upon the utility rests the responsibility for interesting rural customers in equipment that will not only pay for itself and its power bill in cash or kind, but will also show sufficient profit to enable farmers to purchase other appliances to raise standards of living. If the farmer's use of electricity is largely for city comforts, rather than productive applications of power, we will have low average consumption."

Importance of adequate wiring in the post-war selling of appliances was stressed by Dr. George W. Allison, Puget Sound Power & Light Co. He explained the operations of the Home Planners' Institute which is conducting courses in home building and moderization throughout the United States. Adequate wiring and proper lighting is taken up in these courses.

That low initial payments on appliances have proved a detriment to the industry was the opinion expressed by W. C. Mainwaring, head of the merchandising department of B. C. Electric. He claimed that pre-war experience showed that it was easy to secure down payments of 25 percent and that those who sought lower payments were, in many cases, a source of collection and credit difficulties.

S. W. Drury, West Kootenay Power & Light Co., took the attitude that appliances were an expensive item and that unless they were sold on low scale payments, those in the lower-income bracket could not be reached. He said his company sold on terms of $5 down and $5 a month and made many sales to persons with incomes of less than $100 a month.

The success of the Portland General Electric Co. in selling a 3-kw., 30-gallon electric water heater without off-peak control was pointed out by G. S. Dawson, gas sales manager of B. C. Electric, who said that the Canadian electric utilities had to get together and agree on a low-priced waterheater or lose the load to the gas companies. He said that gas companies have decided to promote the sale of automatic laundries and automatic dishwashers just to obtain the water heating load.

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FPC Authorizes Export of Electricity to Mexico

Central Power & Light Co., Corpus Christi, Texas, has been authorized by FPC to continue temporarily exporting 3,000,000 kw.-hr. of electric energy a year to Mexico. The energy, generated in Texas, is delivered to La Junta Federal De Mejoras Materials, a branch of the Public Works of Mexico, and is transmitted across the Rio Grande from Laredo, Texas, to Nuevo Laredo, Mexico.

Temporary authority to connect the electric facilities of Central Power & Light with those of La Junta was first granted on December 1, 1942 when a breakdown of La Junta's generating system resulted in an acute shortage of electric energy in Nuevo Laredo.

Transmission of the electric energy to Mexico will not impair the sufficiency of electric energy in the United States, the FPC stated.

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Youngstown, O., Cuts Tax

To block a referendum vote on its 3 percent utilities tax, Youngstown, Ohio, City Council has repealed the tax which has been in effect since January 18 and substituted another of 2½ percent. The new tax is safe from a referendum since it was enacted with an emergency clause.

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Will Serve Pine Valley

Jacksonville Beach (Fla.) Municipal Electric Department has been given permission of the board of commissioners for St. Johns County to erect transmission lines to serve Pine Valley, Fla.

Move to Outlaw War Time Over but Threat Remains

The Office of War Utilities appeared early this week to have mastered the current drive to outlaw War Time in those states where the issue has been raised, but as long as state legislatures remain in session, chances of new attacks on the capacity and fuel-saving measure remained possible.

Latest additions to the parade of states were Colorado, Texas and Pennsylvania, in none of which was the threat considered too serious. The Colorado bill has been introduced by title only and is unlikely to become law since the legislature plans to adjourn relatively soon. A bill to put Texas in the Mountain Time Zone was introduced early this year, but has not been reported out of committee. Part of the state, including El Paso, now operates on Mountain Time to coincide with New Mexico.

Little was known of the Pennsylvania measure, but legislative policy there is to follow the national policy as far as time is concerned, and it is not expected a bill to junk War Time, in any guise, could become law in Pennsylvania.

In New Mexico, where the House has passed a bill and the Senate may concur, a measure to restore Standard Time on July 1 is not expected to become law.

In Wisconsin, the Senate finally killed a bill to put the state in the Mountain Time Zone. The bill had passed the House and had been debated at length in the upper chamber before its defeat.

Only state to discard War Time thus far this year was Michigan, where the act allowed certain cities, including Detroit, to exercise local option. The adherence of Detroit to War Time cut the losses there appreciably.

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Co-op Will Serve Wendell

Wendell, Vt., has applied to the Halifax (Vt.) Electric Cooperative for electric service. This will necessitate the construction of new power lines into the Wendell area.

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Canadian Output Declines

Central station output in Canada was 3,422,683,000 kw.-hr. in January, a decrease of 3 percent from the 3,528,858,000 kw.-hr. produced in January, 1944. An increase in secondary power from 222,322,000 kw.-hr. to 507,702,000 kw.-hr. helped offset a decrease in primary power from 3,306,536,000 to 2,913,981,000 kw.-hr. or 11.9 percent.

New Power Commission Named by Omaha Mayor

Omaha is back to the point from which it started in 1943 to take over the Nebraska Power Co. All members of the Peoples Power Commission have either died or resigned, and Mayor Dan Butler has appointed with the unanimous consent of City Council six new members.

When Gov. Dwight Griswold appoints two members, the commission, of which the mayor is an ex-officio member, will move to take over the utility, which is now owned by the Omaha Electric Committee, Inc., a non-profit organization, under LB204.

The six new members are Samuel L. Cooper, president and treasurer of Orchard & Wilhelm Co.; David Goldman, secretary-treasurer of Herzbergs, Inc.; J. M. Harding, investments; Clarence L. Kirkland, general manager of Omaha Industries, Inc.; C. E. Metzger, member of Roberts Brothers & Rose Livestock Commission Co.; and Charles D. Saunders, vice-president of the First National Bank.

The unicameral legislature at Lincoln has killed in committee all bills affecting the Omaha power situation except LB139 which would repeal LB204. However, moves are being taken to delay action on this bill with the hope that action can be taken under LB204 to take over the utility.

Attorneys for Nebraska Power have asked for dismissal without prejudice of an injunction suit to prevent the city from cancelling the company's francise. The request was made so that the company could enter negotiations with the new commission without any legal actions standing in the way.

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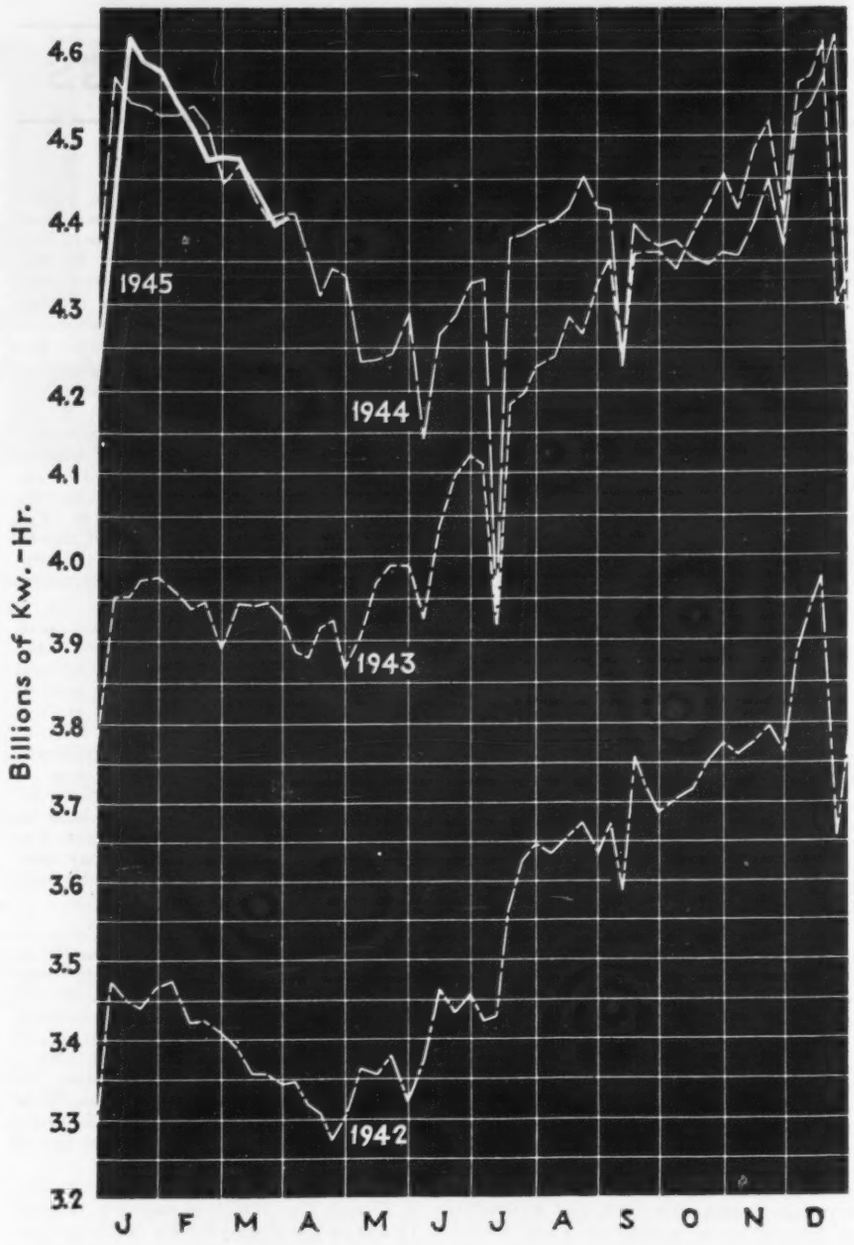
P.U.D. Denied Franchise in Pacific Power District

The Northern Wasco County (Ore.) Public Utility District recently was denied its application for a 25-year franchise which would have enabled it to distribute Bonneville power in The Dalles through the operation of a system competing with Pacific Power & Light Co., of Portland.

Refusal of the franchise application was voted by The Dalles City Council, which took the position that competing lines would not serve the best interests of the community.

Mayor George Stadelman reiterated his earlier suggestion to the P.U.D. that it press its efforts to purchase the P.P.&L. plant at The Dalles and that if such a move failed, to move for condemnation of the property.



Electric Output Curve Turns Upward

Reversing its downward course, the electric output curve moved upward during the week ended March 24, 1945, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,401,716,000 kw.-hr., compared with 4,397,529,000 kw.-hr. during the preceding week. During the week ended March 25, 1944, the amount of electric energy distributed amounted to 4,409,159,000 kw.-hr., this year's figure representing a decrease of 0.2 percent.

Only three of the seven major geographic regions reported losses for the week ended March 24, 1945, as compared with the corresponding week of 1944, the New England group moving into the plus column.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
Mar. 24	4,402	Mar. 25	4,409	Mar. 27	3,928
Mar. 17	4,398	Mar. 18	4,400	Mar. 20	3,949
Mar. 10	4,446	Mar. 11	4,426	Mar. 13	3,945
Mar. 3	4,472	Mar. 4	4,465	Mar. 6	3,947
Feb. 24	4,474	Feb. 26	4,445	Feb. 27	3,893
Feb. 17	4,472	Feb. 19	4,512	Feb. 20	3,949
Feb. 10	4,505	Feb. 12	4,533	Feb. 13	3,940
Feb. 3	4,539	Feb. 5	4,524	Feb. 6	3,960
Jan. 27	4,577	Jan. 29	4,524	Jan. 30	3,977
Jan. 20	4,588	Jan. 22	4,532	Jan. 23	3,974
Jan. 13	4,614	Jan. 15	4,539	Jan. 16	3,952
Jan. 6	4,427	Jan. 8	4,568	Jan. 9	3,953

Percent Change from Previous Year

	Week Ending		
	Mar. 24	Mar. 17	Mar. 10
New England	+ 3.7	— 0.1	— 0.5
Mid Atlantic	— 3.0	— 3.5	— 2.8
Central Industrial	+ 1.8	+ 0.9	+ 1.7
West Central	+ 5.3	+ 5.9	+ 7.3
Southern States	+ 3.6	+ 4.9	+ 6.3
Rocky Mountain	—10.0	— 7.5	— 5.6
Pacific Coast	— 2.1	— 0.1	— 2.1
Total United States	— 0.2	— 0.1	+ 0.5

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission in a series of orders recently issued affecting electric utility companies:

HAS GRANTED, subject to certain conditions, the application of New York Power & Light Co. to offer under competitive bidding $50,000,000 of first mortgage bonds, due 1975, and to issue and sell to its parent, Niagara Hudson Power Corp., 50,000 common stock shares for $5,000,000. The bonds may not be sold until the results of competitive bidding are reported to the commission and it is notified that Niagara Hudson has cancelled advances aggregating $20,500,000 owed to it by New York Power. Proceeds from the sale of bonds and common stock, together with other funds, will be used to redeem the outstanding $55,000,000 of 3¾ percent first mortgage bonds, due 1964, at 107¼ percent plus interest.

HAS SHORTENED from ten to five days the period in which Pacific Gas & Electric Co. may receive bids for $80,000,000 of series M, 3 percent first and refunding bonds, due 1979. At the same time the commission exempted the bond issue from certain provisions of the Holding Company Act. Proceeds plus treasury funds will be used to redeem on June 1 the outstanding $84,193,000 of series G, 4 percent bonds, due 1964, at 105 percent plus interest.

APPROVED PROPOSAL of Cities Service Co. to increase the amount of its investments in securities of and advances to nineteen of its subsidiaries in an amount not to exceed $12,000,000 in the aggregate.

HAS RELEASED its jurisdiction in connection with the proposed sale by Ogden Corp. of 2,165,296 shares of the new common stocks $4 par value of its subsidiary, Laclede Gas Light Co., which it received in connection with that company's reorganization. Jurisdiction also was released with respect to the $19,000,000 of twenty-year first mortgage bonds, due 1965, and $3,000,000 of ten-year serial debentures being offered by Laclede Gas.

APPROVED PAYMENT by Commonwealth & Southern Corp. of a $1.25 dividend on 1,482,000 shares of preferred stock. The dividend, aggregating $1,852,000 will be paid on April 9 to holders of record on March 26.

Applications Filed

UTAH POWER & LIGHT CO. has filed a reorganization plan designed to bring it into compliance with provisions of the Holding Company Act. This is to be accomplished through the issuance of a single class of common stock, instead of existing stocks; the compromise, discharge or settlement of all claims and redistribution of voting power. Utah Power's parent, Electric Power & Light Corp., holder of 92.39 percent of the total voting power, joined in the filing. Electric Power & Light will surrender for cancellation 3,000,000 shares of Utah's common stock and 2,100 shares of its $7 preferred stock for $650,000 and the settlement of all claims against it and against the system's top holding company, the Electric Bond & Share Co. Utah will issue 1,185,241 shares of new $20 par value common stock for distribution to public holders as follows: 4⅞ shares of new common stock for each share of $7 preferred and 4⅜ shares for each share of $6 preferred. The plan will result in the complete separation of Utah from the Electric Bond & Share System.

CENTRAL ILLINOIS ELECTRIC & GAS CO. has registered $14,000,000 of first mortgage bonds, series due 1975, and 30,000 shares of cumulative preferred stock, Series A par value $100 a share, which the company proposes to offer for competitive bidding under Rule U-50. Net proceeds will be applied to the redemption of the outstanding 3¾ percent first mortgage bonds, due 1964, at 104½, and the 3½ and 4 percent debentures. The sum of $1,000,000 of the proceeds will be used to create a construction fund.

SOUTHERN UTAH POWER CO. has asked approval of the issuance and sale of $840,000 of new Series A, 4 percent sinking fund mortgage bonds, due 1970, at 101 percent to the Mutual Life Insurance Co. of New York. Proceeds will be used as follows: $500,593 to redeem $482,500 of 5½ percent first mortgage bonds at 103¾ percent of principal amount; $121,000 to purchase for cancellation 6 percent debentures held by Southern Utah's parents, Washington Gas & Electric Co. and $219,306 to pay cash expenditures for net property additions.

Hearings Scheduled

APRIL 3: On proposal of Carolina Power & Light Co., a subsidiary of National Power & Light Co., to offer holders of its 173,506 shares of outstanding $7 and $6 preferred stock the right to exchange such shares for a new issue of preferred stock with a dividend rate of $5 per share. Shares of the old preferred not exchanged would be called for redemption at the redemption price of $110 a share through the use of treasury cash.

APRIL 11: On plan filed by Louisville Gas & Electric Co. (Del.) pursuant to Section 11 (e) of the Public Utility Holding Company Act of 1935, and on declaration filed by Standard Gas & Electric Co. pursuant to Sections 10 and 12 (f) of the Act and pursuant to Section 11 (b) (2) of the Act with respect to Louisville Gas & Electric Co. (Del.), which three proceedings have been consolidated. March 14 was originally designated for the hearing, but the Mayor of Louisville indicated that the City of Louisville wishes to participate and requested postponement for sixty or ninety days for the reason that flood conditions in Louisville demand the undivided attention of city officials. SEC postponed the hearing to April 11.

APRIL 12: On proposal of Virginia Electric & Power Co. to issue and sell under competitive bidding conditions $33,000,000 principal amount of first and refunding mortgage bonds, Series E, due March 1, 1975, with the interest rate, price to be received by the company and the underwriters' spread to be determined by the successful bidder. Proceeds from the sale of the bonds, together with funds in the amount of $3,044,191 held in escrow by the trustee under the mortgage securing the Series B bonds, and general funds of the company are proposed to be applied to the redemption at the current call price of 105 of the outstanding $37,500,000 principal amount of first and refunding mortgage bonds, Series B, 3½ percent, due September 1, 1968.

UTILITY REPORTS

	Net Income 1945	1944
*Birmingham Electric	$1,616,749	$1,297,986
*Central Arizona Lt. & Pwr.	731,291	895,509
†Detroit Edison and subs.	5,577,739	8,779,252
*Louisiana Power & Light	1,111,709	886,384
*Puget Sound Power & Light and subs.	5,052,061	5,475,488
†Texas Electric Service	1,797,129	1,782,422
	1944	1943
‡Boston Edison	5,214,147	5,394,148
‡California Elec. Power and subs.	**1,278,873	1,170,667
‡Central Hudson Gas & Elec.	1,045,081	1,338,622
‡Columbia Gas & Electric and subs.	13,709,726	14,137,012
‡Duquesne Light	9,877,941	10,548,453
‡Engineers Public Service and subs	6,952,352	5,595,123
‡Oklahoma Gas & Electric	**2,440,020	2,562,425
‡Philadelphia Elec. and subs.	16,798,828	15,751,521
‡Utah Power & Light and subs.	1,722,495	1,854,916

*Twelve months ended January 31.
†Twelve months ended February 28.
‡Twelve months ended December 31.
**Preliminary.

Virginia Utility Sells All of Its Transit Properties

At midnight, March 31, Virginia Electric & Power Co. will go out of the transportation business by turning over all its transit properties to the four companies whose bids were accepted on March 1.

The Portsmouth system will go to A. C. Allyn & Co., Chicago, and the Equitable Securities Co., Nashville, Tenn. Their bid was $611,450. These same companies bought the Richmond and Norfolk transit lines from Virginia Electric a few months ago.

Galleher & Co., Richmond, have purchased the Newport News lines for $335,500; Bankers' National Investing Corp., Wilmington, Del., the Petersburg system for $170,000; Carolina Coach Co. of Virginia, Raleigh, N. C., the Richmond-Petersburgh interurban line for $155,100.

Duke Power Co. Buys System

Duke Power Co. has purchased the distribution system owned by the Rosman Tanning Extract Co. in Rosman, N. C., and has been granted 60-year franchise by the Rosman board of aldermen.

Officials said that construction of a three-phase line from Brevard to Rosman has been started, and when this is completed, Duke Power Co. will take over all of the retail and commercial customers in Rosman. It will also furnish power for street lights and the Toxaway Tanning Co.

HOW

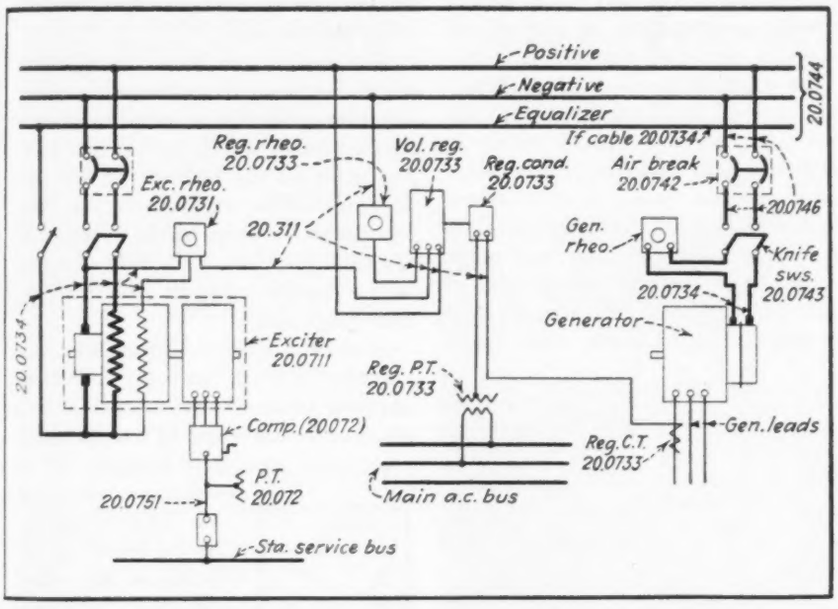
DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Engineering Aid to Accountants

To assist plant accountants and engineers in visualizing various equipment layout details on the New England Power System, V. R. Baukat of the engineering staff of the New England Power Service Co., Boston, suggested providing plant account code books with schematic diagrams illustrating the major features of such installations.

In assembling basic data for plant account records it is important for accountants to have before them definite ideas of the electrical set-ups identified in the code, and by combining the code listings with diagrams numbered according to the items tabulated, identification is facilitated. This is particularly useful in wartime, when clerical forces may lack familiarity with plant features which are an every-day story to the engineer.

In many cases one-line diagrams of layouts suffice, but in the example illustrated, the complete scheme of connections is shown for a generator excitation system. These pages are useful to engineers as well as to accountants, especially in connection with studies of layout costs, checking work orders and supervising the clerical side of installation work.



Description

20.07—Account and Unit Code Number Excitation System	20.074 D. C. Bus & Equipment
20.071 Exciter (Separately driven)	20.0741 Supporting Structure
20.0711 Exciter (D.C. Gen.—A.C. Motor —Steam Turbine)	20.0742 Breakers (OCB or ACB)
20.0712 Foundation	20.0743 Switches
20.072 Exciter Starting Equipment	20.0744 Main Buses
20.073 Field Control Equipment	20.0745 Bus Supports
20.0731 Exciter Field Rheostat	20.0746 Circuit Wiring
20.0732 Field Control Panel	20.0747 Panel Wiring
20.0733 Voltage Regulator	20.0748 Instruments
20.0734 D. C. Power Cable	20.075 A. C. Conduit & Cable
20.0735 D. C. Power Conduit	20.0751 A. C. Cable
	20.0752 A. C. Conduit
	20.311 See Control Conduit & Cable System.

TYPICAL CODE BOOK PAGE listing items and diagramming generator excitation system for use of accountants and engineers facilitates identification of items

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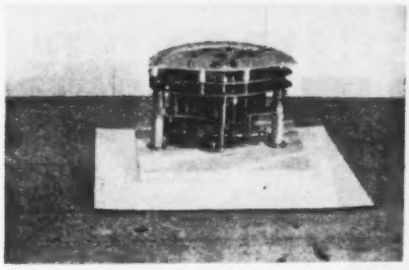
Jig Protects Stored M-20 Demand Registers

By C. W. PINKEL
Illinois Power Co., Belleville, Illinois

Due to rate changes recently we have had quite a few M-20 demand registers that were removed from meters to be stored until needed at some future date. It was found that the original steel bracket, used in shipping, had been junked and the storing of these registers would be difficult without damaging the gears on the register unless some sort of bracket were made to hold the register upright. It was also found necessary to protect the register worm gear, other small gears and the demand pointer hand while register was in storage.

In order to provide a low cost jig and yet one which would afford ample protection for the register the following material was used. The base of the jig or bracket is made of a block of $\frac{1}{4}$ in. hard wood, 4 in. wide and $5\frac{1}{2}$ in. long. Two $\frac{1}{8}$-in. holes were drilled along the center line of



REGISTER attached to ¼-inch hardwood board before wrapping and labeling for storage

the block 3¾ in. from center to center. Eight penny nails were inserted through these holes. Three ½ in. washers were placed over each nail to form part of the distance needed to bring the register to proper height over the wood base. Then one spacer used in converting G. E. I-14 meters (most meter shops have a surplus supply of these spacers) was placed over the top of washers on each nail. After this the register was placed over the nails and the set screws (used to fasten register to meter) were tightened down onto the nails. This held the register in a rigid position.

A small piece of card board was placed over the dial face and demand pointer. The supporting block and register was then wrapped in heavy shipping paper. A tag showing the register ratio, voltage of timing motor, class of scale and full scale of demand dial was attached with string to the register. The register was then ready for storage and was protected from dust and damage.

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Distribution Diagram Has Novel Features

By R. C. MORRIS

System Distribution Engineer, Union Electric Co. of Missouri, St. Louis, Mo.

Several unusual but practical features have been incorporated in a new system diagram recently installed in the distribution dispatching office of the Union Electric Co. of Missouri, St. Louis, from which distribution feeder operations, line trouble, and customer trouble calls are dispatched for attention.

Outstanding feature is the presentation, to scale of 400 ft. per in., on a single diagram 8 ft. high and 20 ft. long of the entire 4,160-volt distribution system for the City of St. Louis, showing geographical as well as all necessary electrical features.

The diagram is drawn on ordinary light green wall-linoleum, cemented to a 1-in. ply-wood panel which is mounted on an angle iron frame-work and bound and framed with a narrow aluminum molding. Street and alley boundaries, street names, and other geographical features are shown in dark green. Electrical circuits and equipment are in black, with heavy lines denoting three-phase circuits and lighter lines for the single-phase circuits. Also shown are transformers with their phase indicated, cable terminals, line switches, and wire sizes. Switch symbols show their normal open or closed position.

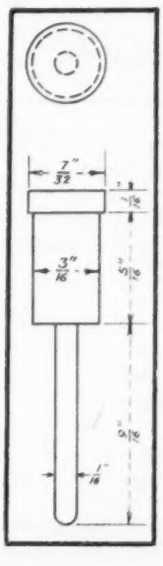
Abnormal operation is indicated by red and green plastic pins. Elimination of all pins except those indicating abnormal operation is a small but important detail, as the pins thus immediately attract the attention of the dispatcher to abnormal operations. This feature is particularly valuable when shifts are changed. These pins were turned out of knitting needles in our shop.

The combination of colors was selected after small scale trial of several combinations to (1) eliminate any strain on the eyes of the dispatchers, (2) permit a large amount of detail without confusion, and (3) to bring out the electrical circuits most prominently but with the geographical features readily discernible for diagnosing line troubles, routing trouble calls, and the like.

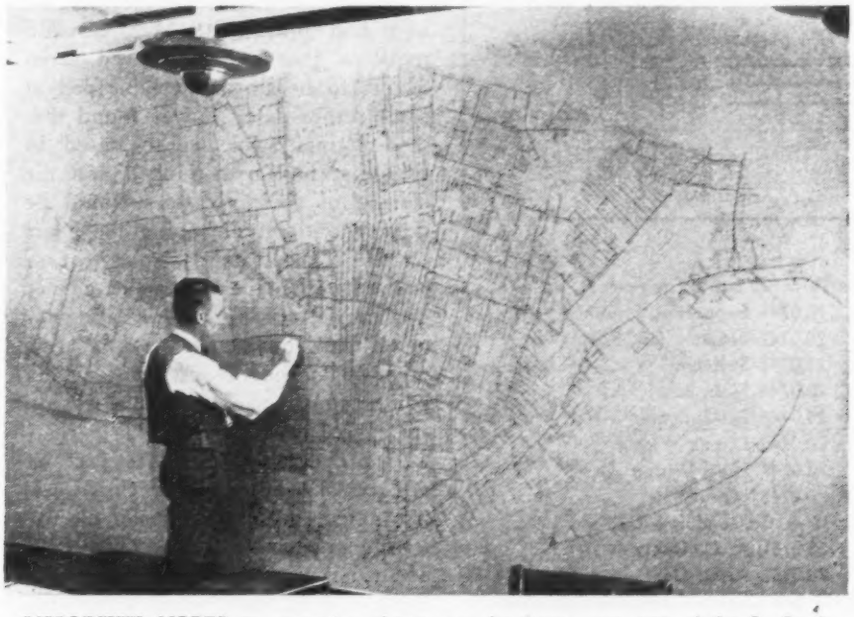
The design was based on eighteen years' experience with an earlier diagram of similar principle but on a smaller scale, 600 ft. per in., and lacking many of the features of the new diagram. This experience has fully convinced the users of the superiority for this purpose of a single diagram over a number of small circuit or section diagrams.

A smaller diagram of the 13-kv. distribution system and the overhead portions of the 33-kv. system is in a panel at the right end of the main diagram and separated from it by an aluminum molding. All 13-kv. customers, indexed switch locations and other essential electrical information is shown on this diagram, but much of the geography is omitted.

The new diagram was designed and



RED and green plastic pins, turned from knitting needles, indicate abnormal operating conditions on system operating diagram



DISPATCHER MARKS an operating change on the huge new map of the St. Louis 4.16-kv. system in the distribution dispatching office of Union Electric Co. of Missouri

drawn by the record division of the distribution engineering department, with much counsel and advice from the distribution dispatchers, supervisors, and others directly responsible for distribution system operation.

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Orderly Fusing of Distribution Transformers

By M. M. DEVORRIS
Transmission and Distribution Department
Pennsylvania Edison Co., Altoona, Pa.

In many instances essential data covered by the operating instructions are not readily available at the time that the lineman is confronted with the work at hand. This is especially true in the matter of re-fusing transformers of various sizes and voltages, and the availability in the hands of the lineman of the required fuse links. To effect the use of the proper fuse links, the following procedure was established:

A small metal box (tool box) was provided for each line and service truck for carrying a supply of fuse links. On the inside of the cover of this box a fuse schedule was pasted, in addition to indicating the fusing for the various size and voltage transformers, space was provided for recording the quantity of each size of fuse line which is to be carried in that particular fuse kit. Thus, for example, small trucks used for rural work only, would not carry the larger capacity fuses in any quantity, except as might be required for re-fusing branch lines, etc.

Without Excess Stock

This fuse stock tabulation enables the operator of a vehicle to maintain proper supply of fuse links without carrying an excess stock of sizes which might rarely be used in the particular section serviced by this truck. An experience covering ten years with this arrangement has indicated its value.

In order to effect the same simplicity of operation for branch line fusing, aluminum tags are installed about 8 ft. above the ground on the pole supporting the line fuse cut-outs. A glance at this tag indicates to the lineman the size of fuse link required in re-fusing the particular line cut-outs at that point. This eliminates the extra climbing of the pole by the lineman in re-fusing line fuse installations.

Experience has indicated, also, that the drain on the central storeroom for links has been leveled out, and less difficulty is experienced in anticipating fuse line usage through the central storeroom because the personal element has been eliminated in the stocking of the individual fuse kits.

SCHEDULE OF TRANSFORMER FUSING

Kva.	Fuse rating for 2,300 volt transformers				Fuse rating for 4,600 volt transformers				Fuse rating for 6,900 volt transformers			Fuse rating for 11,000 and 13,800 volt transformers			Fuse stock	
															Size	Type
	1 transformer	2 transformers	3 transformers	One 3-ph transformer	1 transformer	2 transformers	3 transformers	One 3-ph transformer	1 transformer single-phase	2 transformers open delta	3 transformers closed delta	1 transformer	2 transformers	3 transformers	1	Cable
															2	Cable
															3	Cable
															3	Plug
															5	Cable
1.5	3	3	5	...	1	2	3	...	1	1	1	5	5	5	5	Plug
3	5	5	10	...	2	3	5	...	2	2	3	5	5	5	10	Cable
5	10	10	20	...	5	5	10	...	3	3	5	5	5	5	10	Plug
7.5	15	20	25	...	5	10	10	...	5	5	10	5	5	5	15	Cable
10	15	20	30	15	10	10	15	5	5	5	10	5	5	5	15	Plug
15	15	30	40	20	10	15	20	10	5	10	15	5	5	5	20	Cable
25	25	40	60	30	15	20	30	15	10	15	20	5	5	10	25	Cable
37.5	30	60	75	40	15	30	40	20	10	20	30	10	10	15	30	Cable
50	50	60	100	40	...	...	...	...	15	25	40	10	15	20	40	Cable
75	60	100	100	60	...	...	...	...	20	40	60	15	20	25	50	Cable
100	75	100	100	60	...	...	...	...	25	50	75	20	25	30	60	Cable
															75	Cable
															100	Cable

For transformers above heavy line use 45 C6 cut-outs
For transformers below heavy line use 75 C1 cut-outs
For 6,900 volt transformers use XFL-2,430 cut-outs
For 11,000 and 13,800 v. transf. use XFL-2,830 cut-outs

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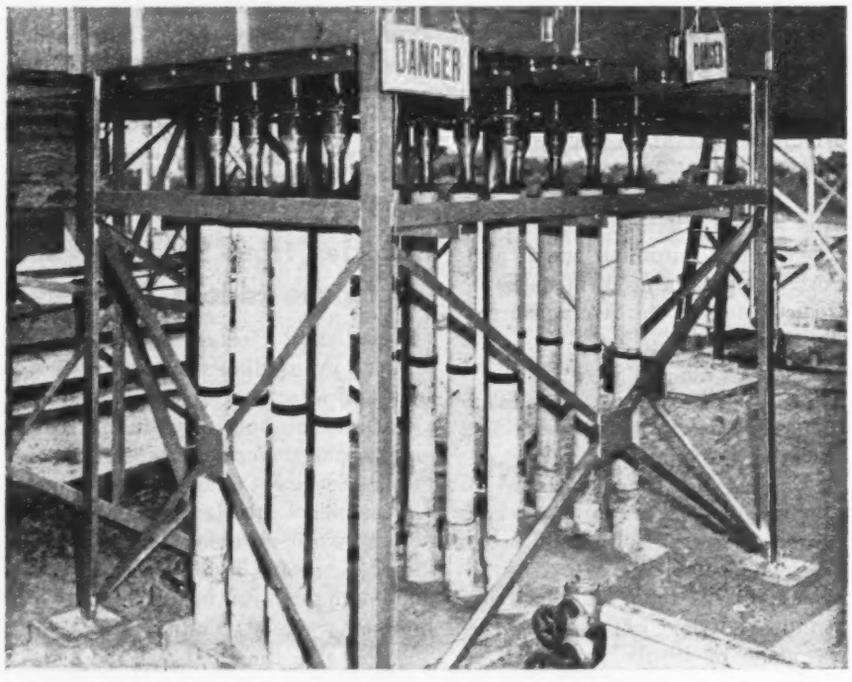
Cable Riser Ducts Waterproofed



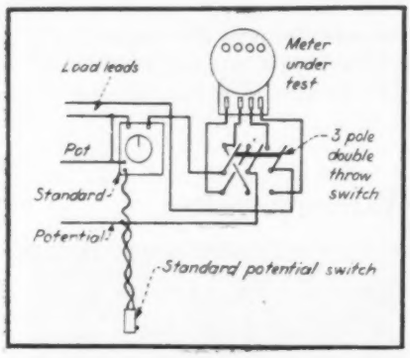
TRANSITE DUCT FOR CABLE RISERS as well as for the complete runs was used by Pacific Gas & Electric Co. for the four 1,000,000-cir. mil lead covered cables per phase required for a new synchronous condenser at its Herndon substation. Sealing compound in the ends of the Transite duct makes the job waterproof. The illustration shows the twelve cables entering the underside of the tertiary bus compartment of a 90,000-kva., 230-v. transformer bank

Shortens Test Time for 3-Wire Meters

By J. P. DAWSON
Meter Engineer,
Woodstock (Ont.) Public Utilities Commission

Using only a three-blade double-throw switch as extra equipment we save half the former testing time on 3-wire house meters. The switch is wired up as shown in the sketch below.

In operation the four leads from the switch go to the meter, and the switch is closed in either direction. The test is started in the usual manner with the pushbutton potential switch, and when half the run is completed the three-pole switch is closed in the opposite direction. This connects the meter with the other coil in the circuit. On completion of the run the test is stopped in the usual manner with the pushbutton switch but the error indicated on the rotating standard is the *average* error of the two coils of the meter.



SWITCH UNIVERSAL in mid-run connects other coil of 3-wire meter

This system eliminates three runs per meter as a minimum and it also removes the possibility of mistakes in the calculation of the average error of the meter.

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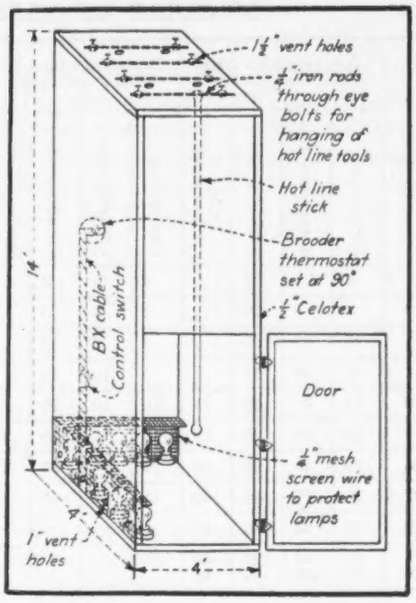
Home Made Oven Drys Hot Sticks

Linemen of the Parsons district of the Kansas Electric Power Co., use a home made drying oven to keep wooden parts of their hot line tools dry and safe when not in use. The oven, made of insulation board, is four ft. square and 14 ft. high. Racks are provided at the top to which tools are clamped. Heat is provided by eight 250-watt CX Mazda lamps in the bottom. A brooder thermostat set at 90 deg. keeps the temperature



HEATING, DRYING and storage cabinet for hot line tools and other devices

uniform within the oven at all times.

Hot line tools are left in the oven except when on the trucks. Week ends after rainy or foggy weather switch sticks, which are usually kept in the trucks, are placed in the oven. This insures the drying out of any moisture which could have entered the wood through minute breaks in the spar varnish.

The oven is also used to dry varnish after sticks have been refinished. Wood sections of air break switch handles are also dried in this cabinet after treatment and before installation, Guy A. Knarr, electric superintendent reports.

•

Cubicles from Scrap House Indoor Breakers

Neat sheet metal cubicles, assembled by welding from scrap sheet steel and structural angles are doing a wartime job housing indoor circuit breakers at an outdoor substation of Public Service Co. of Indiana, Inc.

Sheet metal cubicles have been used before by this company during peacetime for housing indoor breakers applied outdoors. But in the case at Columbus, wartime conditions prohibited the allocation of steel sheet for cubicles of this type. Approval for their fabrication was granted promptly, however, when it was discovered that the cubicles could be built from scrap available in the local fabricators' plant and that materials used required no stock replacement.

Accompanying picture shows one of the "scrap" cubicles, of which there are three. Each is 4½ ft. wide, 5 ft. long and 7½ ft. high at the top of the pitch roof. Six roof bushings carry 4-kv. circuit leads in to and out from the 15-kv. breaker. Double doors front and back give access to the breaker which is mounted on an angle iron frame within.

Cubicle framework, to which the sheet is attached, is of 2 by 2 in. angles. Sheet metal panels are assembled from scrap plates that are offset, lapped and welded at the joints. Roof and doors of the structure are 11-gage, sides 14-gage sheet. The floor inside the cubicle is also of sheet scraps butt-welded.

INDOOR OIL CIRCUIT BREAKERS used for outdoor duty are housed in sheet metal cubicles built from a local sheet metal fabricators scraps

For ventilation, 4 by 6 in. screened openings are provided one foot from the floor at the sides and at the top of the cubicle both front and back. All such openings, four in all, are provided with rain sheds.

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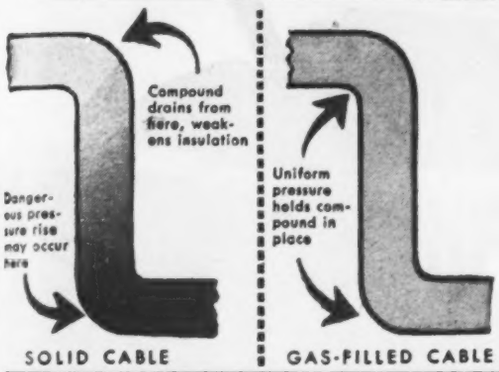
"Jacob's Ladder" Saves Cable Sheath

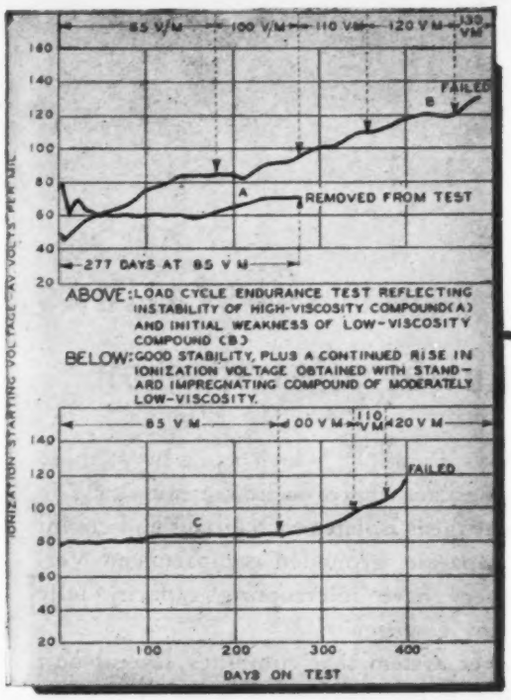
"Jacob's Ladder" is the name given to an instrument used in the hauling of a partial reel of cable from which the lags have been removed. As is well known a winch line applied to such a reel would result in damage to the cable sheath.

This ladder-like tool, developed by the Philadelphia Electric Co.,

What COMPOUND VISCOSITY has to do with the service strength of G-E gas-filled cable


Compound drains from fibre, weakens insulation
Danger-ous pres-sure rise may occur here
Uniform pressure holds compound in place
SOLID CABLE
GAS-FILLED CABLE

VISCOSITY of the impregnating compound in solid-type cable must be objectionably high, if migration is to be avoided. Migration of compound results in dry insulation at the top of a grade, and excessive pressure at the foot of steep grades or vertical risers. In gas-filled cable, the gas spaces and the uniformity of pressure throughout greatly reduce this migratory effect. Profile no longer sets the lower limit for compound viscosity. Vertical risers of any height compatible with the tensile strength of the cable or supports are feasible.



LOAD-CYCLE ENDURANCE TESTS, conducted on sample cables covering a wide range of viscosities, have given us significant facts on their ultimate dielectric strength. At the start, the heavy compounds (Saybolt 1000 at 100 deg C) show high ionization voltage, but no *increase* in stability occurs (A). Thin compounds, on the other hand, start very poorly, even though they show a continual rise in stability due to automatic grading and "X-wax" formation within the voids (B).

THE STANDARD IMPREGNATING COMPOUND used in G-E mass-impregnated gas-filled cable (Saybolt 100 at 100 deg C) does not drain objectionably and shows good stability right from the start. Yet it has sufficient mobility to permit automatic grading and self-healing action. In the tests (see chart) ionization was extinguished at each upward voltage step until 120 volts per mil was applied. Only after 16 days at this extreme level did failure occur.

Taken together with the self-supervising feature, which warns of sheath damage, this *self-protecting ability* of mass-impregnated gas-filled cable helps explain why G.E. regards it as tomorrow's universal cable-type, within its recommended voltage ranges. ***General Electric Company, Schenectady 5, N. Y.***

RATINGS: LOW-PRESSURE TYPE, 10 TO 40 KV; MEDIUM-PRESSURE TYPE, 40 TO 69 KV

GENERAL ELECTRIC

501-25-1200

BUY ALL THE BONDS YOU CAN—AND KEEP ALL YOU BUY

COMPACT, self-contained G-E unit substations are "strong points" of modern power distribution

It seems incredible. But the fact is that each of the two factory-built G-E unit substations you see above handle one-third *more* power than the entire conventional (gingerbread) layout at the top of the opposite page. They do it with lower electrical losses, and afford greater protection for personnel. Installed as a part of a well-planned, modern power-distribution *system,* they help to assure greater continuity of power to every point of use.

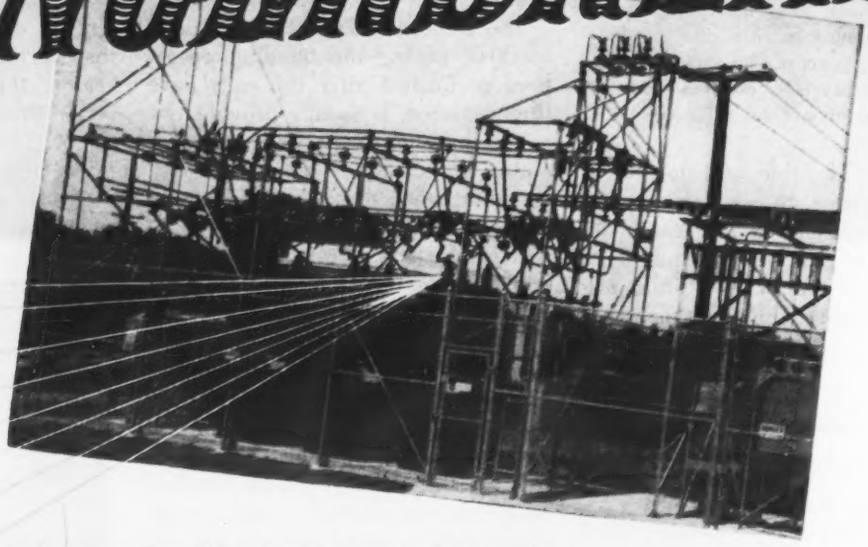
G-E unit substations practically eliminate the manpower problems of assembly on the job. They come ready to connect, combining the necessary transforming capacity, cable-termination facilities, and high-voltage and low-voltage switchgear. The transformer section of each unit is sealed against dirt and dampness. With Pyranol*, which can't burn, these substations can go anywhere, outside or indoors. The metal-clad switchgear isolates each circuit and circuit breaker in a separate, grounded compartment. Vertical-lift breakers have interrupting capacity fully adequate for any emergency.

A plant power system that combines several unit substations close to the load centers is highly flexible. Increased loads can be met, step by step, with duplicate units. And war-plant records of "unit subs" in service show unusual savings in maintenance and man-hours. Ask your G-E representative for the story. *General Electric Company, Schenectady 5, New York.*

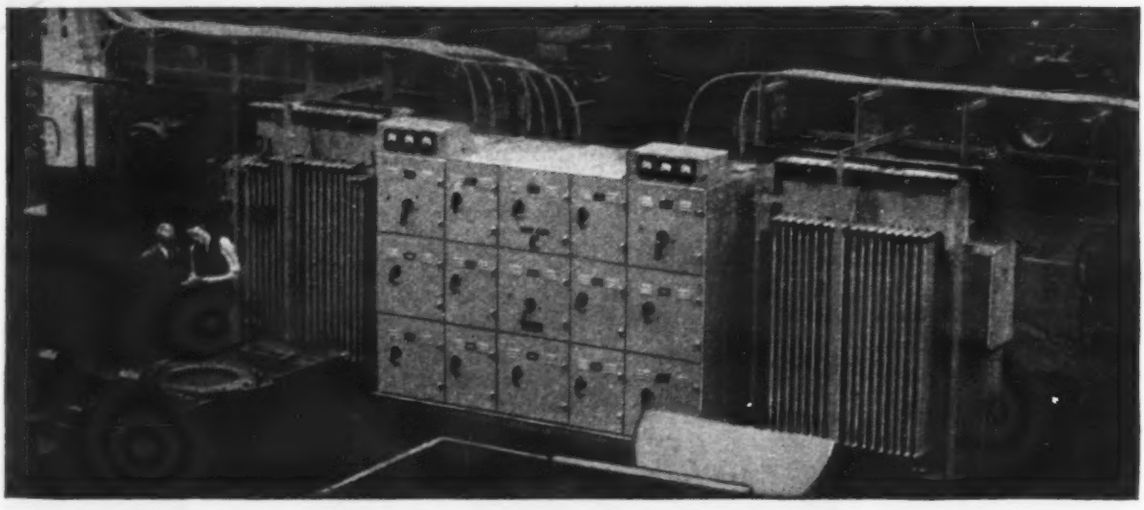
*Trade-mark Reg. U.S. Pat. Off.

Buy all the BONDS you can—*and keep all you buy*

. . to GINGERBREAD



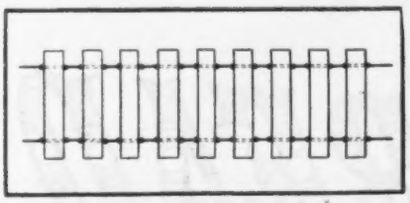
WHAT A CONTRAST between the two modern G-E unit substations on the opposite page, which serve nine 300-hp pump motors, and the layout above, which serves only three 500-hp pump motors. Yet even the gingerbread substation above affords better protection than many old-time "briar-patch" installations still in service.



INDOORS, EVEN MORE ADVANTAGES are made possible by G-E unit substations combined in a co-ordinated, load-center distribution system. They can be placed in factory work-areas, thus keeping short the heavy-copper secondary circuits, and overcoming voltage-drop problems economically. Unlike open switchboards and oil-cooled transformers, they need no isolation wards indoors.

LOAD-CENTER POWER DISTRIBUTION SYSTEMS

GENERAL ELECTRIC



"JACOB'S LADDER" made of ⅜-in. rope sewed through holes drilled in reel lags and knotted on each side to maintain a 4-in. spacing. Sufficient length of rope is provided at each end to permit tying around the cable reel

is a series of cable reel lags held together by rope. In use it is wrapped around the reel and tied in place. The winch line is then placed around the ladder and the reel of cable lifted into the truck without damage to the cable sheath.

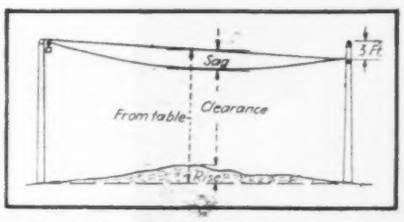
•

Ground Clearances Corrected for Sag, Rise

By R. PHILIP HART
Manager, Cazenovia (N. Y.) Electric Co.

It has been found convenient to have the accompanying table of clearances at hand when laying out rural lines. Clearances given are for mid-point of span with no sag considered; this figure must be corrected by deducting sag and adding or deducting "dip" or "rise" of the ground. Pole setting depths are not the standard ones generally used, but less in some cases.

Of course, when a span is considered with crossarm on one pole and bracket on the next, the low point may occur at the bracket itself. This point should receive consideration.



TABULATED VALUES of clearance for three-pole top gradients must be corrected for sag and for intervening rise

Ground Clearances at Midpoint of Span

Pole Lengths ft.	Pole Setting ft.	Ground Clearance ft., with no sag allowed: Cross arms	Arm to Bracket*	Brackets spaced 3 ft.**
25 & 25	4.5	20.5	19.0	17.5
25 & 30		22.75	21.25	19.75
25 & 35		25.0	23.5	22.0
30 & 30	5.0	25.0	23.5	22.0
30 & 35		27.25	25.75	24.25
30 & 40		29.5	28.0	26.5
35 & 35	5.5	29.5	28.0	26.5
35 & 40		31.75	30.25	28.75
40 & 40	6.0	34.0	32.5	31.0

* Arm on one pole bracket on next.
** Lower wire 3 ft. below pole top.

• • •

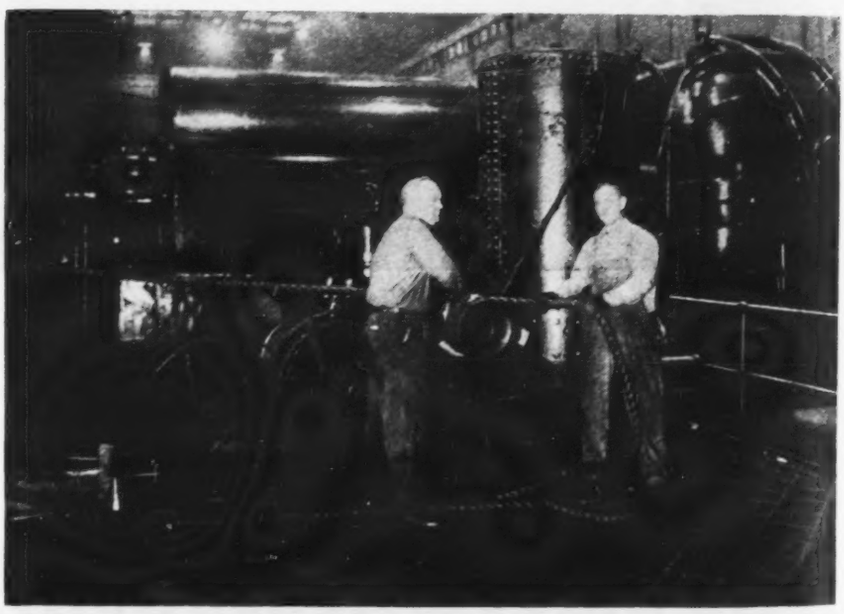
Air Motor Used During Banding Operation

The force necessary for turning a machine during the banding operation, performed after the coils have been replaced, is usually provided by a turning motor. However, such a motor is not always present or easy to obtain when this operation is performed. Such was the case when the General Electric Service Department did a job of this type on an eastern utility's property.

In this instance a steam winch was used as a compressed air motor. It drew its air from the regular 80 to 90 psi. station air tank. The air turning motor was belted by a 2-in. rope to the machine to be banded. This rope was wound around the air motor pulley several times to prevent slipping; it was also wound around the machine rotor several times for the same reason.

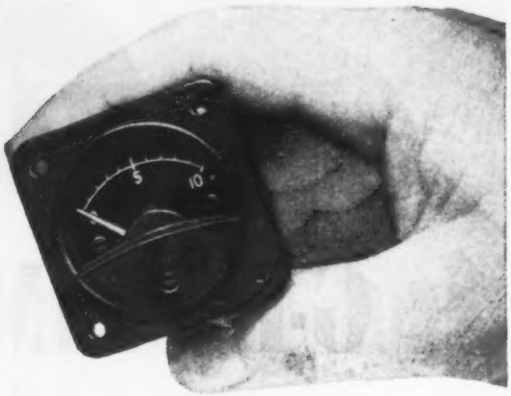
The top rope, which is under tension, pulls the machine rotor around at approximately one rpm. or 35 lin. ft. per minute. This rotation is started by the workmen putting a slight tension on the rope at the point it comes off the pulley and as long as this tension is maintained the rotor will rotate. In order to stop the rotation to inspect the work, or for any other reason, the workman merely slacks off on this rope on the off-side of the pulley. This ease of starting and stopping, plus the low speed obtained, made the air-operated steam winch a successful substitute for the non-existing turning motor.

INJURY TO COILS is prevented by one inch planks. Banding wire is being driven over to lay tight against adjacent turn. Means of maintaining and measuring wire tension are also illustrated for this building operation



STEAM WINCH OPERATING as a compressed air motor used to turn rotor during banding operations. Workman keeps slight tension on off-coming rope to prevent slipping; starting, stopping and slow speed are easily obtained

Here They Are!



The New 1½ INCH

G-E PANEL INSTRUMENTS

To meet the need for compactness, especially in electronic and communication devices for combat, they have a body diameter of only 1½ inches, are less than 1 inch deep, and weigh only 3 ounces. They are accurate to within ±2 per cent.

These instruments are of the internal-pivot construction, and in addition to small size and light weight, they have all the other desirable features associated with this unique G-E design.

Because of its high torque and large-radius pivots, the element (which is common to both instruments) is well able to withstand vibration. High torque combined with a lightweight moving element results in fast response. Good damping makes for ease and accuracy of reading. Large clearances help to insure reliable operation.

All these features add up to a high factor of merit and all-round excellent performance.

For advance information, ask the nearest G-E office for Booklet GEA-4380, or write to General Electric Co., Schenectady 5, N. Y.

WATERTIGHT

TYPES DN-1, -2, -3

(Left hand, above)

● For applications where equipment may be used in an extremely humid atmosphere, exposed to rain, or accidentally submerged in water. Available for direct-current (DN-1), radio-frequency (DN-2), and audio-frequency (DN-3) service.

CONVENTIONAL

TYPES DN-4, -5, -6

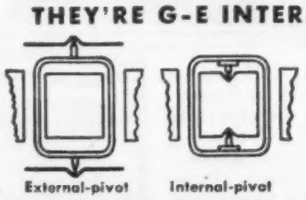
(Right hand, above)

● For use on aircraft and on communications or electronic devices where the instrument is protected. Available for direct-current (DN-4), radio-frequency (DN-5), and audio-frequency (DN-6) service.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

Buy all the Bonds you can—*and keep all you buy*

THEY'RE G-E INTERNAL-PIVOT INSTRUMENTS



One advantage of the internal-pivot design is compactness. Armature, core, control springs, pivots, jewels, balance weights, and pointer form a single, self-contained unit, all parts of which are supported by a cast-comol magnet.

GENERAL ELECTRIC

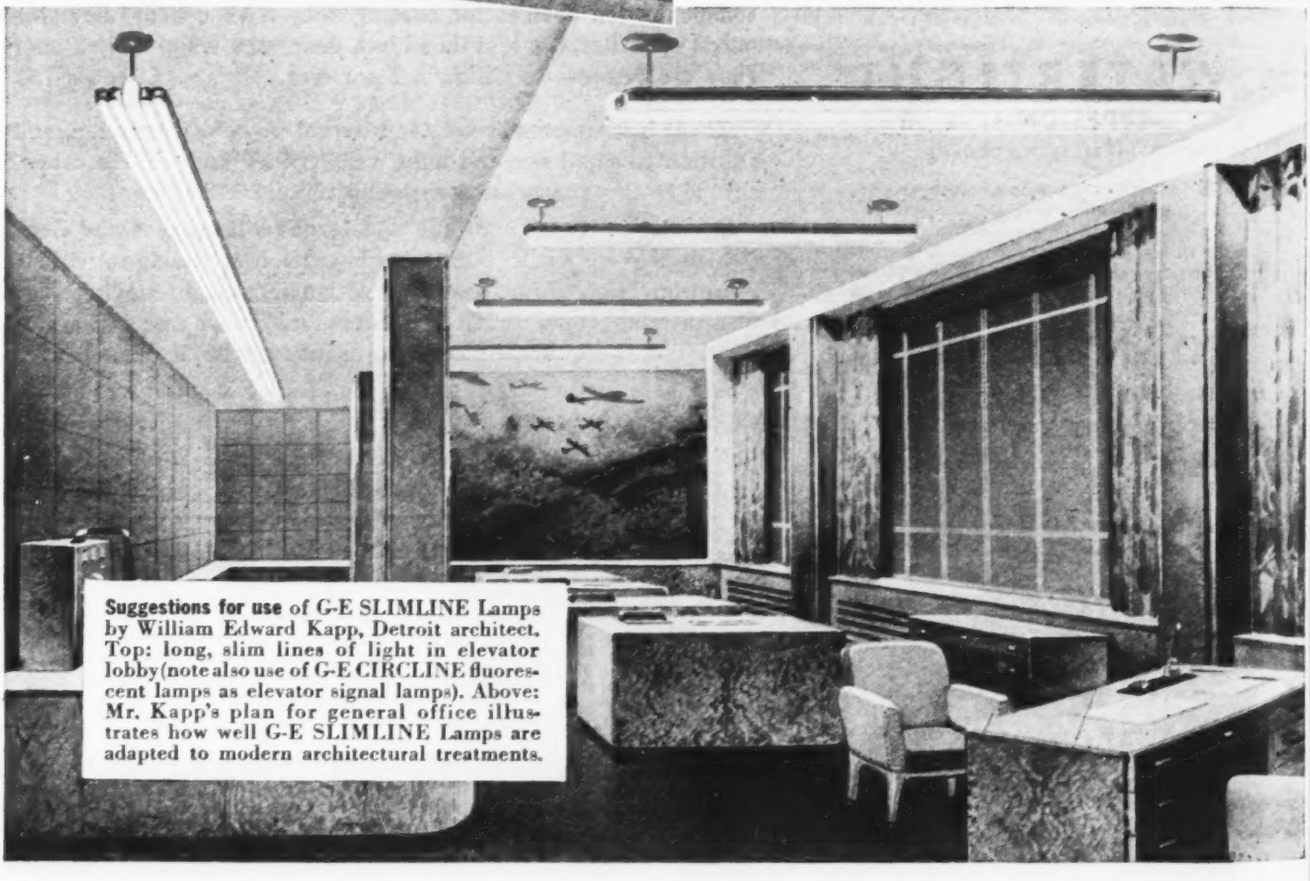
602-83-6200

TWO NEW NAMES

1 G-E SLIMLINE fluorescent lamps

Several months ago, General Electric announced the G-E SLIMLINE—four new fluorescent lamps with unique new design and operating advantages. These slimmer fluorescent lamps, up to eight feet in length, promise a wealth of new lighting opportunities, especially in the commercial field.

G-E SLIMLINE lamps will be available in two diameters: three-quarters of an inch (42″ and 64″ long) and one inch (72″ and 96″ long). Other outstanding features: (1) instant starting, (2) long life, (3) higher efficiency—average of 60 lumens per watt, (4) operation singly, in multiple or in series and (5) operation over a range of current values from 100 to 200 milliamperes. Quantity production of G-E SLIMLINE Mazda Fluorescent Lamps will proceed as soon as conditions permit.



Suggestions for use of G-E SLIMLINE Lamps by William Edward Kapp, Detroit architect. Top: long, slim lines of light in elevator lobby (note also use of G-E CIRCLINE fluorescent lamps as elevator signal lamps). Above: Mr. Kapp's plan for general office illustrates how well G-E SLIMLINE Lamps are adapted to modern architectural treatments.

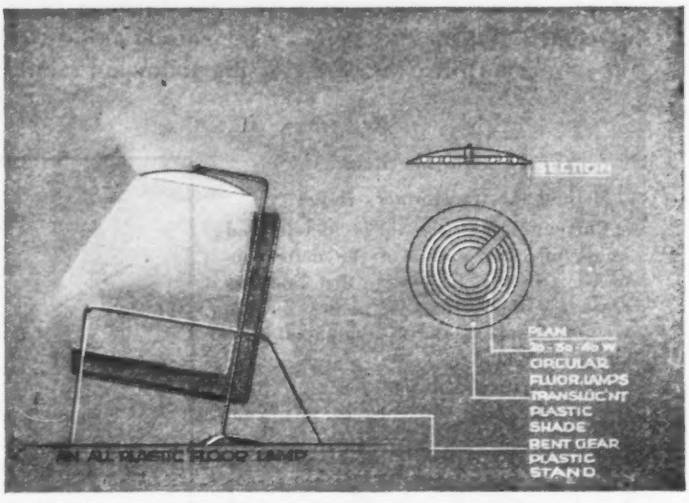
TO REMEMBER:

2 G-E CIRCLINE fluorescent lamps

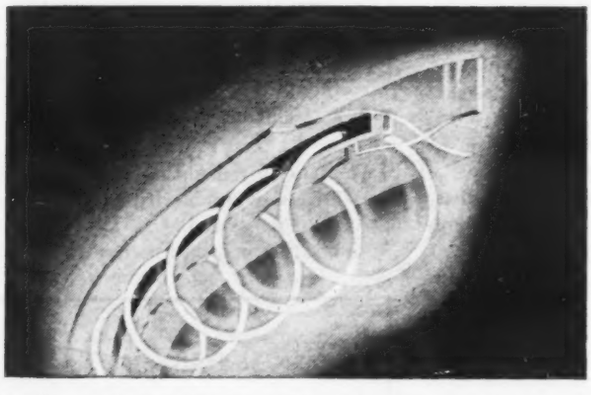
Architects commissioned by G-E to suggest creative ideas for postwar lighting, have been quick to take advantage of the dramatic new design opportunities afforded by G-E CIRCLINE Fluorescent Lamps. Examples are the illustrations on this page.

Present plans call for three circular lamps with approximate outside diameters of 8½, 12¼ and 16 inches. Bulb diameters are expected to range up to 1¼ or 1½ inches, and approximate watts from 15 to 50.

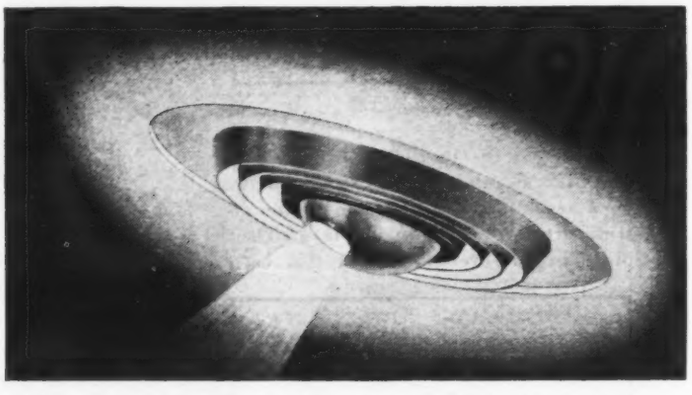
In addition to their use in commercial lighting applications, circular fluorescent lamps probably will find a place in portable and ceiling lamps for the home, either alone or in combination with filament lamps. Final design and production of G-E CIRCLINE Fluorescent Lamps will proceed when conditions permit.



Nest of three G-E CIRCLINE Fluorescent Lamps is used in this floor lamp. Shallow plastic shade gives maximum light. Design suggested by N. A. Owings, of Skidmore, Owings and Merrill, architects, Chicago.



Wurdeman & Becket, architects, Los Angeles, envision use of G-E CIRCLINE Lamps in this fixture for stores. Rings of light at regularly spaced intervals in ceilings are designed to direct customer traffic to rear of store. The cast phenolic reflector suggested here would help direct light down on the aisle.



Another Wurdeman & Becket design for a ceiling luminaire for stores, combining G-E CIRCLINE Lamp with filament lamps and spotlamp. At center is R-40 spotlight for dramatic highlighting of merchandise. Above it, a G-E CIRCLINE lamp illuminates bowl. Two 100-watt filament lamps, one on each side of center bowl, furnish general illumination.

BUY WAR BONDS AND HOLD THEM

Hear the G-E radio programs: "The G-E All-Girl Orchestra", Sunday 10:00 p. m. EWT, NBC; "The World Today" news, Monday through Friday 6:45 p. m. EWT, CBS; "The G-E Houseparty," Monday through Friday 4:00 p. m. EWT, CBS.

"To make G-E Lamps STAY BRIGHTER LONGER" — The Constant Aim of G-E Lamp Research

G-E MAZDA LAMPS

GENERAL ELECTRIC

HOW TO CALCULATE UNBALANCED CURRENTS IN DELTA CONNECTIONS

By R. Philip Hart, President, Cazenovia Electric Co., Cazenovia, N. Y.

A graphical method simplifies the computation of current in secondaries of transformers of a closed delta bank, also of load balance on delta-connected rural feeders, for the following conditions: unbalanced loads on each of three phases, only line current values are available, and the power factor is the same for each single-phase load connected to the circuit.

Transformer Banks

Method for transformers follow.

Current values are to be determined in circuits 1, 2 and 3 of the delta connections in Fig. 1. Assume that line currents for the respective phases on the secondary are: A = 25 amp., B = 40 amp., C = 50 amp.

The graphical solution is:

Plot the line currents to any convenient scale as in Fig. 2, using ZX = 25. XY = 40, and YZ = 50. Also draw, on a separate piece of tracing paper, a symmetrical Y as shown in Fig. 3. Then place Fig. 3 over Fig. 2 so that each leg of the Y will coincide with one of the vertices of the triangle; push a pin through the vertex of the Y on the tracing paper and determine the location of point O.

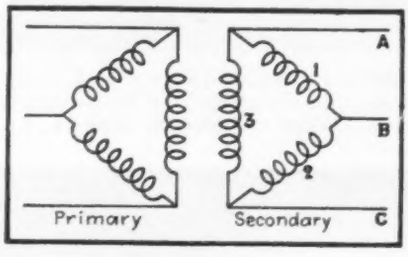


FIG. 1—Bank of transformers

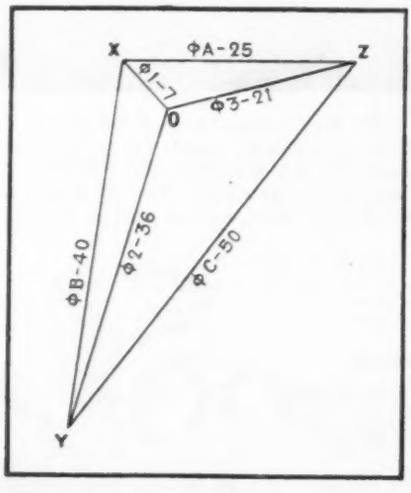


FIG. 2—Transformer solution

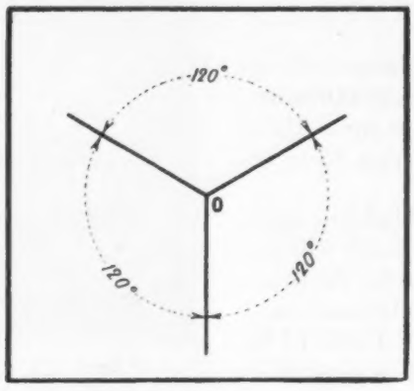


FIG. 3—Symmetrical Y

The transformer values can then be scaled off graphically thus:

XO is common to phase A and phase B, therefore it is phase 1 and measures 7 amp.

YO is common to phase B and phase C, therefore it is phase 2 and measures 36 amp.

ZO is common to phase C and phase A, therefore it is phase 3 and measures 21 amp.

Rural Feeders

Method for rural feeders follow.

Assume a three-phase, delta-connected feeder with phase currents A = 26 amp., B = 40 amp., C = 35 amp., as indicated in Fig. 4. Load D is 10 amp. It is desired to find out how a transfer of load D from BC connection to CA connection will affect the balance at the substation.

The procedure is as follows:

Plot the load triangle ZXY (Fig. 5). Determine the point O by using the symmetrical Y (Fig. 3) on tracing paper, as explained above. The currents between phases are XO, YO and ZO. A load D is between B and C, it is obvious that it is part of OY. It can be scaled as YY' and the point Y' marked. As we propose to connect this load to phases A and C, it must be subtracted graphically from OY and added graphically to OZ with which it will be in phase. This graphic transfer of load D determines the point Z'.

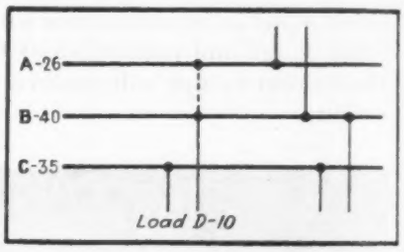


FIG. 4—Loads on a rural feeder

The new currents at the substation will now be given graphically by XY'Z' and when scaled are found to be 34.7 amp., 31 amp., 34.5 amp., respectively.

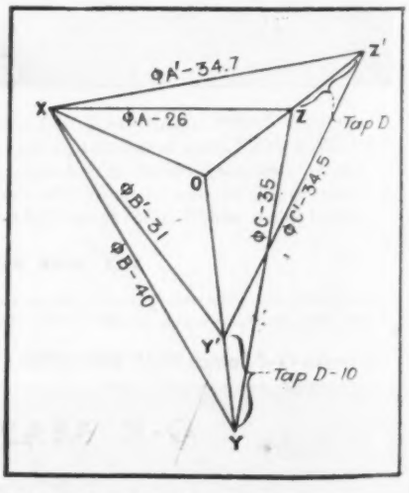


FIG. 5—Rural feeder solution

FLAMENOL* BUILDING WIRE

(SMALL DIAMETER)

Thermo-plastic Insulated Wire
For Complete Wiring Systems

Type SN
FOR GENERAL PURPOSE WIRING

Type SNW
FOR WIRING IN WET LOCATIONS

Flamenol* thermo-plastic insulated building wire will meet all requirements for new wiring, reconversion wiring or maintenance wiring. It is available in sizes 14 to 2,000,000 CM and can be used for feeders, branch circuits or special wiring. Two types of Flamenol Building Wire are available—Type SN for general purpose wiring and Type SNW for wiring in wet locations.

Flamenol Building Wire was developed before the war and has proved its worth in thousands of installations. Its small diameter makes it easy to install and permits more copper to be placed in conduits. Its tough insulation has long life, is high in dielectric and mechanical strength and is resistant to oils, acids and alkalies. In addition, Type SNW Flamenol wire insulation has low moisture absorption.

FOR FURTHER INFORMATION about Flamenol Building Wires, other wires, conduits or wiring devices, see the nearest G-E Merchandise Distributor or write to Section C D W 354-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

BUY WAR BONDS AND KEEP THEM

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news Mon. through Fri. 6:45 P.M. EWT, CBS.

*Reg. U.S. Pat. Off.

G-E CONDUITS AND WIRING DEVICES

G-E conduits and wiring devices will meet every requirement. In the G-E line are White and Black rigid conduits, EMT, flexible conduit, Fiberduct and hundreds of wiring devices including switches, outlets, sockets, fuses, fluorescent lampholders and starters, etc.

THE OWNER'S BEST OVER-ALL INSURANCE

R. A. Goeller, Vice Pres., Hatzel & Buehler, Inc., New York, N. Y., says, "Adequate wiring, whether it be in the home, factory or office, is the owner's best over-all insurance of his investment. This must be the keystone of the electrical contractor's philosophy toward his customer."

ADEQUATE WIRING SERVES AND SAVES — THE KEY TO THE HOME OF TOMORROW

GENERAL ELECTRIC

DETERMINE BENDING AND RESISTING MOMENTS OF POLES

Chart and graph are designed for wood poles and are adapted from recently published Discussion Handbook H39, National Electrical Safety Code, part 2, National Bureau of Standards.

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Accompanying nomograph (Fig. 1) has been developed for use in obtaining the bending moment at the ground line on a wood pole due to transverse wind pressure on that pole.

Instructions: To use nomograph lay straightedge across chart from K to H and read bending moment at M_1 or M_2.

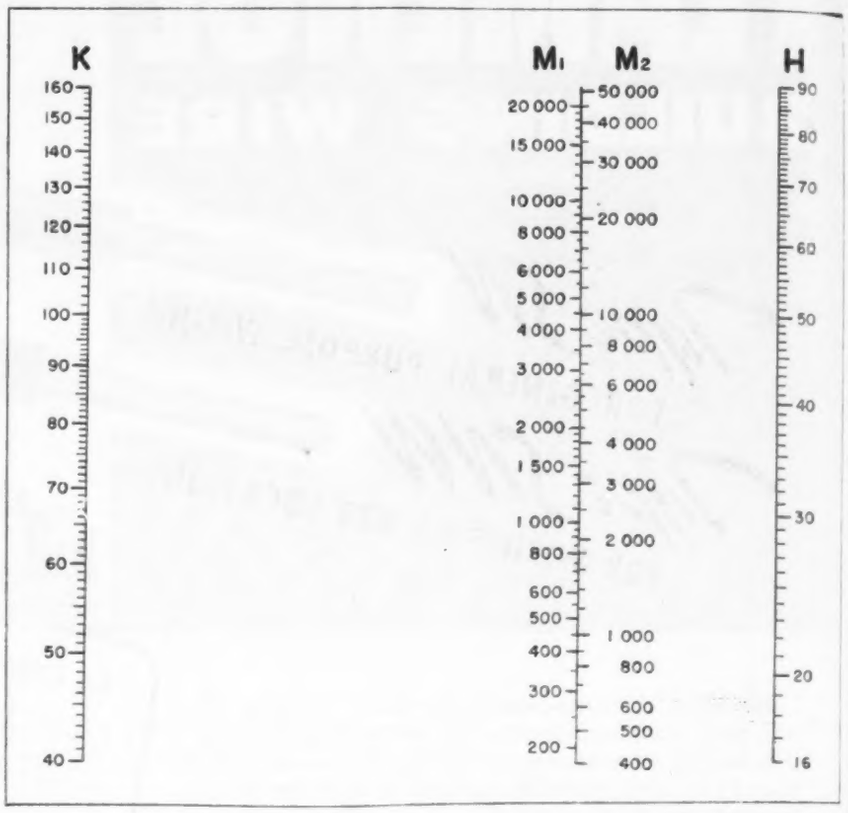

FIG. 1—Bending moment due to wind pressure on pole. $K = 2T + G$, where T = circumference at pole top, in inches and G = circumference at ground line, in inches. H = height of pole above ground line, in feet. M_1 = moment at ground line for heavy and medium loading, in pound-feet. M_2 = moment at ground line for light loading, in pound-feet

•

Ultimate resisting moments of wood poles corresponding to various pole circumferences at the ground line are obtainable from the graph (Fig. 2) which gives values for eight species of woodpole timber. The curves are based on ultimate fiber stresses (lb./in.) as follows:

(1) Creosoted southern pine and Douglas fir, 7,400;
(2) Lodge pole pine, 6,600;
(3) Chestnut, 6,000;
(4) Western red cedar, 5,600;
(5) Cypress, 5,000;
(6) Northern white cedar and redwood, 3,600.

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NOTE: These charts published by U. S. Department of Commerce, National Bureau of Standards and designated as Miscellaneous Publication M176, charts 2A and 2B, in enlarged form 14 by 22 in. (price 25 cents), and the Handbook H39 (price 75 cents), are obtainable from Superintendent of Documents, Washington 25, D. C.

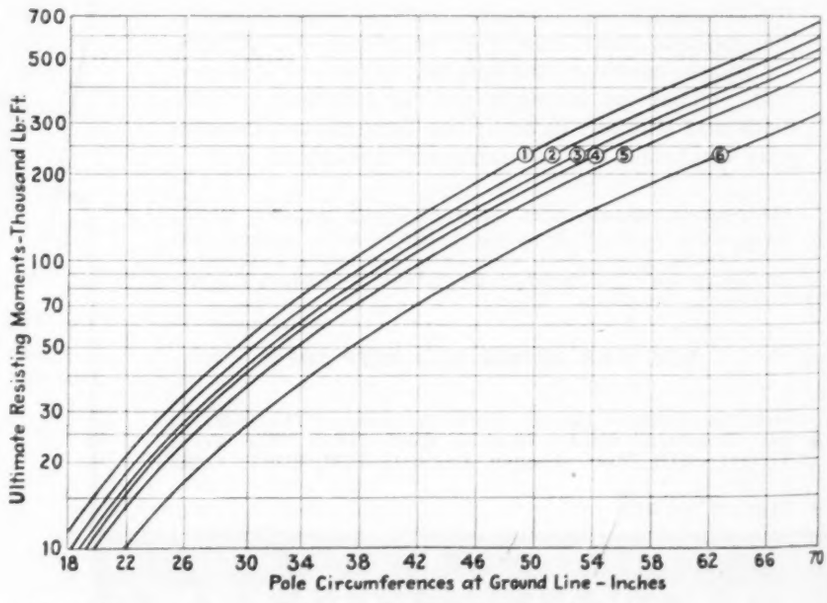
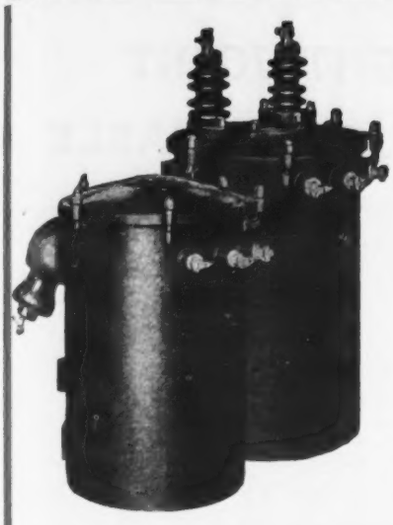


FIG. 2—Ultimate resisting moment of poles of eight species of timber

MOLONEY TRANSFORMERS



Single-phase Transformers

Conventional Single-phase Distribution Transformers are available in capacities from 1½ to 500 Kva, in voltages up to 66,000 volts.

Illustrated are small Conventional Single-phase Distribution Transformers typical of voltage ratings of 2400, 7200 or 13,200 to 120/240 volts. From left to right they are Type KL (pocket mounted HV bushings), and Type CL (cover mounted HV bushings) representative of sizes 1½ to 50 Kva, and Type KL (with tubes) representative of sizes 75 and 100 Kva. These conform to EEI-NEMA Standards.

MOLONEY CONVENTIONAL DISTRIBUTION TRANSFORMERS

Moloney Conventional Distribution Transformers are widely used on utility distribution systems and in industrial lighting and power applications.

All transformers are of core type construction and are provided with liberal oil ducts exposing the maximum amount of coil surface to the liquid thereby improving the cooling of the windings and increasing the life of the insulation.

The windings are designed with insulating materials so distributed, as to keep the electrical stresses at a minimum. The insulation level is uniformly high, reducing the possibility of damage resulting from lightning surges. Bushings are coordinated with the winding insulation level so that in event of a surge the bushings flash over before the windings are damaged.

Secure the advantage of over 47 years of specialization in the manufacture of transformers by specifying Moloney transformers for your next installation.

Three-phase Transformers

Conventional Three-phase Distribution Transformers are available in capacities from 10 to 500 Kva in voltages up to 66,000 volts.

At right are illustrated small Conventional Three-phase Distribution Transformers of Moloney Type TCL design which includes cover mounted HV bushings and sidewall mounted LV bushings. The transformer on the left is typical of sizes 10 to 37½ Kva. The transformer on the right equipped with cooling tubes is typical of sizes from 50 to 200 Kva. These are also available in Type TKL having pocket mounted HV bushings and sidewall mounted LV bushings.

MOLONEY ELECTRIC COMPANY • ST. LOUIS, U. S. A.

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Chicago, Ill.....100 West Monroe Street
Dallas, Tex.....709 Thomas Bldg.
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Detroit, Mich.....16123 Grand River Drive
1744 New Center Bldg.
Grand Rapids, Mich.....412 Houseman Bldg.
Houston, Texas.....4411 Navigation Blvd.
Indianapolis, Ind.....909 Roosevelt Bldg.
Kansas City, Mo.....624 Dwight Bldg.
Knoxville, Tenn.....Harrill-Hills
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New Orleans, La.....428 Baher Bldg.
New York, N. Y.....55 Liberty Street
Omaha, Nebr.....503 Sunderland Bldg.
Pittsburgh, Pa.....837 Oliver Bldg.
Portland, Ore.....1233 N. W. 12th Avenue
St. Louis, Mo.....5390 Bircher Boulevard
Salt Lake City, Utah.....314 Kearns Bldg.
San Francisco, Calif.....420 Rialto Bldg.
Seattle, Wash.....532 First Avenue, South
Shreveport, La.....630 Spring Avenue

CONSTRUCTION OF STRAIGHT JOINT FOR COMPACK SECTOR CONDUCTOR CABLE

Four straight joints designed for three-conductor, paper and lead cable, suitable for underground or aerial service and for operating voltages of 13,800 and 27,600 on grounded or ungrounded systems. Accompanying outlines are adapted from construction standards of The United Illuminating Co., New Haven and Bridgeport, Conn. These are normal standards and do not reflect wartime shortages of materials.

•

Fig. 1—Joint for 2/0 conductor cable, 13,800 volts, 16/64-in. insulation, shielded

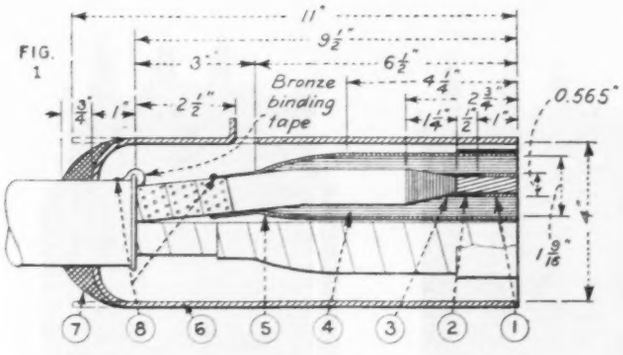
Fig. 2—Joint for 250,000 cir. mil. conductor cable, 13,800 volts, 16/64-in. insulation shielded

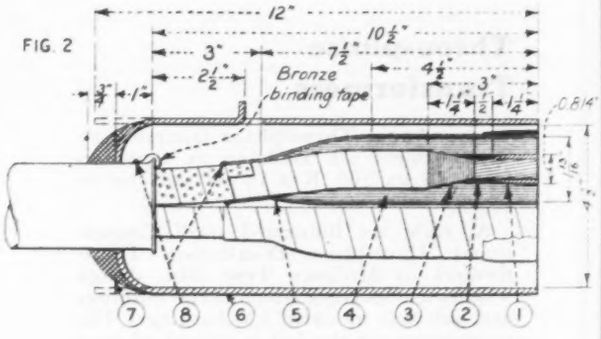
Fig. 3—Joint for 350,000 cir. mil. conductor cable, 13,800 volts, 16/64-in. insulation, shielded

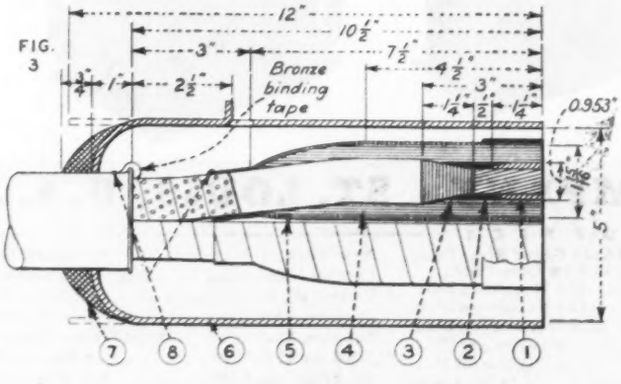
Fig. 4—Joint for 4/0 conductor cable, 27,600 volts, 22/64-in. insulation, shielded

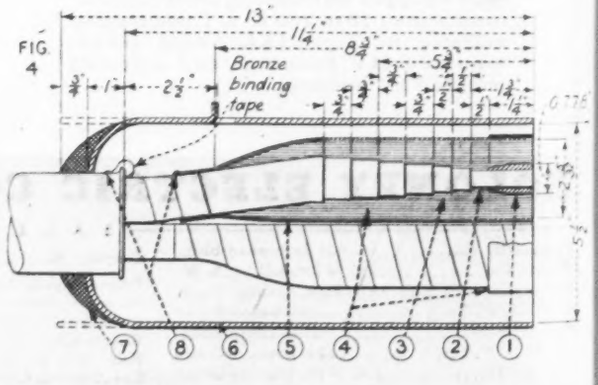
LIST OF MATERIAL

Item	Description	Quantity			
		Fig 1	Fig 2	Fig 3	Fig 4
1	Connectors, Compack Sector, NELA Spec.	3–2/0	3–250 Mcm.	3–350 Mcm.	3–4/0
2	Bias cut V. C. tape, ¼ in. x 0.010 in., 4-yd. roll	4	8	11	22
3	Bias cut V. C. tape, ¾ in. x 0.010 in., 4-yd. roll	7	8	8	22
4	Bias cut V. C. tape, ¾ in x 0.010 in., 16-yd. roll	10	11	14	23
5	Copper mesh braid, ¾-in.	45 ft.	60 ft.	65 ft.	85 ft.
6	Lead sleeve, inches	22x4x5/32	24x4½x5/32	24x5x5/32	26x5½x3/32
7	Wiping solder, 40% tin x 60% lead	6 lb.	7½ lb.	8 lb.	9 lb.
8	Stick solder, 50% tin x 50% lead	½ lb.	½ lb.	½ lb.	½ lb.
9	Basting oil	2 qt.	2 qt.	2 qt.	2 qt.
10	Filling compound	1½ gal.	1½ gal.	2 gal.	2½ gal.
11	Stearine	2 oz.	2 oz.	2 oz.	2 oz.
12	Asbestos roving	5 ft.	5 ft.	5 ft.	5 ft.
13	Gilling thread	10 ft.	10 ft.	10 ft.	10 ft.
14	Cotton tape, ¾-in.	10 ft.	10 ft.	10 ft.	10 ft.
15	Paper pasters, 2-in.	5 ft.	5 ft.	5 ft.	5 ft.
16	Cotton yarn				100 ft.
17	Aloxite cloth	1 ft.	1 ft.	1 ft.	1 ft.

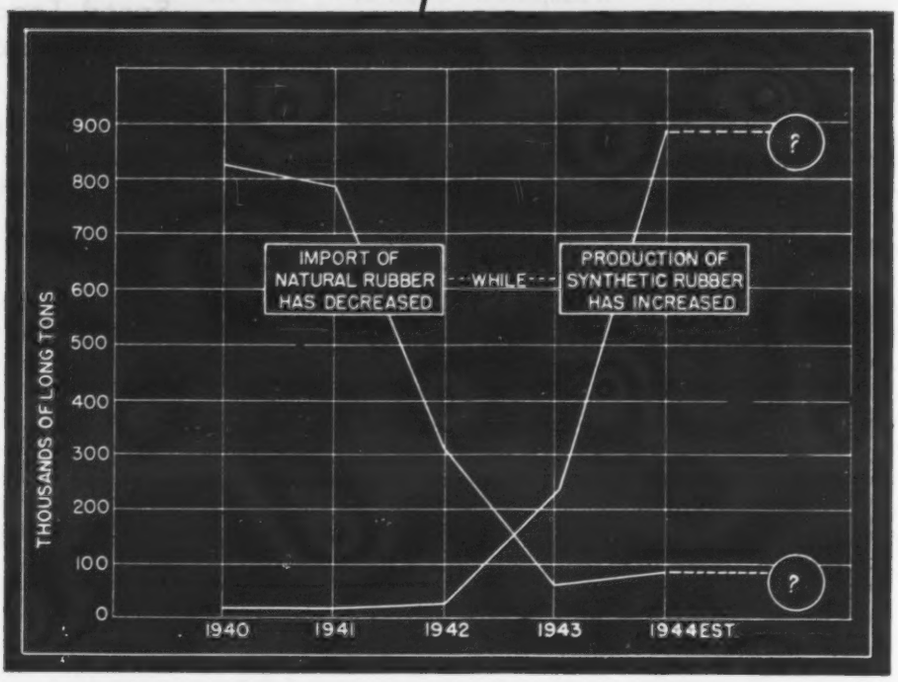








Simplex Synthetic Rubber Compounds for electric wires *and* cables *exceed expectations*



The results obtained with synthetic rubber compounds that have replaced our many prewar, special purpose, natural rubber insulations and sheaths have exceeded our expectations. As long as only synthetic rubbers are available, we shall produce the best possible product with synthetics. When natural rubber is again available we shall recommend the type of cable insulation most suitable for efficient, trouble free service.

Synthetic compounds will have some postwar uses that natural rubber cannot match. In such fields they will continue to be preferred but for many types of service the natural rubber compounds will again be first choice. Relative availability and cost, political and industrial restrictions and national security will have a bearing on the future of the two products.

There will be a postwar place for both natural and synthetic rubbers. The inevitable postwar expansion of the electrical industry promises a big future for all types of insulated wires and cables, each having certain fields of usefulness in which it excels.

May we discuss with you the advantages of cables specially designed to fully meet your requirements?

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex
WIRES and CABLES

Dry-Type Transformers; Overload, Fault Tests

Representative of abnormal operating conditions for dry-type transformers employing Class B insulation were some overload and fault tests conducted to demonstrate the load-carrying ability of the units. These tests were primarily for transformers ranging in size from 150 to 4,000 kva. and in voltages up to and including 15,000. How the tests were made were explained by W. W. Satterlee, Transformer Engineer of Westinghouse Electric & Manufacturing Co., Sharon, Pa., in a paper presented at a recent meeting of International Association of Electrical Inspectors in Albany, N. Y.

In one test, a winding assembly withstood a sustained short circuit of 15 times normal current for 2 min. without reaching a temperature high enough to ignite the varnish. The copper temperature was in excess of 400 deg. C. It should be noted the winding was subjected to this short circuit for 2 min., which is fully 25 times longer than the 3 to 5 sec. normally required for overcurrent protective relays or breakers to clear a circuit under the same conditions.

Insulation Breakdown

Another test consisted of a power arc of over 5,000 amp. sustained for a short time in a transformer which had first been pre-heated to 100 deg. C., an approximate normal operating temperature, without ignition of the varnish. This is representative of an insulation breakdown in the windings of a transformer connected to the lines of a power system.

Still another test consisted of applying a sustained overload (120 percent of rated load) to transformers of this type for 27 hr. followed by 167 percent of rated load for 20 hr. The windings reached a constant temperature of approximately 270 deg. C. Considerable smoke was given off but the varnish did not ignite. Two hundred percent of rated load was applied immediately and the varnish did not take fire until after 3 hr. and with the windings at a temperature of approximately 400 deg. C.

These tests demonstrate that this type of air-cooled transformer will carry continuously in excess of 160 percent of rated load before ignition of the varnish might occur. Actual experience under emergency operating conditions has shown that loads heavier than this may be carried for reasonable periods of time without the transformer windings reaching a temperature which would cause the insulation to smoke.

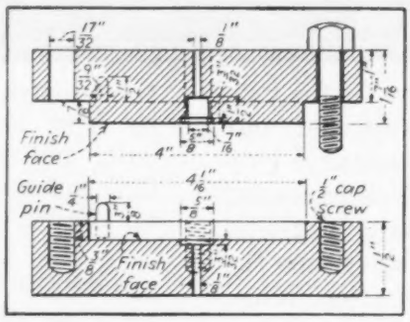
•

Aluminum Meter Disks Straightened

By L. C. ROBERTS
Supt. of Meters
Staten Island Edison Corp., Staten Island, N.Y.

A simple kilo-watt-hour meter disk-straightener which has been effective in rehabilitating aluminum disks has been made in our meter department. The tool or jig made out of cold rolled steel is applicable to all sizes and all makes of standard kw.-hr. meters.

To use the jig, the bent disk is set into the lower half of the tool with the shaft in the ⅛-in. center hole. The upper half of the jig is carefully lowered over the upper end of the meter shaft making certain that the guide pin on the lower section engages the guide slot on the upper.



DISK STRAIGHTENING jig made of cold rolled steel. The ⅛-in. center hole engages disk shaft and the disk itself is compressed between the two finishing faces. Pressure is applied by the four ½-in. capscrews which are 2 in. long. Disk is given a permanent set and shaft alignment is corrected.

The disk is straightened by gradually increasing the tension on the four ½-in. capscrews in successive steps so that the pressures are approximately equal. This process presses out any irregularities in the aluminum disk between the two finishing faces and at the same time will correct any irregularities in alignment between the disk and the shaft.

After compressing the disk as much as possible, it is left in the jig overnight to assure a permanent set.

•

Speed, Load Control on Interconnected Systems

II—Need for Adjustability

By E. E. GEORGE*
Electrical Engineer, Ebasco Services, Inc., N.Y.

Any automatic regulating system has a region of adjustment, where it improves stability or steadiness of operation, and a region of adjustment where it increases any unbalance, causes oscillation or swinging, and makes matters worse instead of better. In other words, it may work with or against the natural, self-regulating characteristic of the system to which it is applied.

To be economically practicable most controllers have to be designed to fit various types of systems. If the design is such that the device can be applied to almost any system, it is likely that it can be adjusted to cause instability. Critical adjustments are in the rate of application of control and in delay in applying control.

There is an optimum relation between the inertia constant of the power system, the kw. frequency characteristics of the power system, the rate of change of power output, and the delay in changing the output. In the case of either electrical or mechanical speed or load control devices, the rate of change of power output and the delay in changing the output may be limited by fuel and air supply, water carry-over, steam pressure or pen-stock pressure changes, turbine temperature change, governor design or governor adjustment. If telemetering equipment is used, there are additional delays, because most of the telemeter systems are of the pulsating or intermittent type and do not give continuous instantaneous transmission and reception of the quantity to be controlled. Likewise, automatic load-control equipment introduces some delay since it sends only intermittent pulses.

The balancing of rate control application and delay in control against inertia and system characteristics was

* Cause of speed change and necessity for automatic control devices was discussed in the March 17 issue of ELECTRICAL WORLD, page 84.

"This is your answer to the Lead Problem," says Romey

ROME CABLE SYNTHINOL* TYPE SNW

Lead is scarce and a critical material. As stated in the official Lead Order No. M-38, the available supply must be conserved. Lead is now available for certain specific uses only.

So Romey says Rome Cable SYNTHINOL* Type SNW is your answer to the lead problem.

This type is approved by the Underwriters Laboratories for use under Section 3035 of the National Electric Code in Raceway Systems — (1) underground, (2) in concrete slabs of masonry in direct contact with the earth, (3) in wet locations, (4) where condensation and accumulation of moisture within the raceways are likely to occur.

With the thermoplastic synthetic insulation you get all these essential properties:

- ✔ WATER RESISTANCE
- ✔ ACID RESISTANCE
- ✔ SOLVENT RESISTANCE
- ✔ SMALL DIAMETER
- ✔ WIDE COLOR RANGE
- ✔ AGING
- ✔ DIELECTRIC STRENGTH
- ✔ ABRASION RESISTANCE
- ✔ FLAME RESISTANCE
- ✔ HIGH INSULATION RESISTANCE
- ✔ COLOR STABILITY
- ✔ TENSILE STRENGTH
- ✔ FLEXURAL STRENGTH
- ✔ TOUGHNESS (Impact strength)
- ✔ EASY PULLING (Lubricated finish)
- ✔ EASY STRIPPING

Standard colors are black, white, red, green, yellow, blue, orange and brown.

FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION

ROME • NEW YORK

Model 33-VTF can be mounted in several ways—rack and panel installation shown is typical. Only the meter appears in front—electronic unit may be mounted on same panel or at some remote location.

MODEL 33-VTF, now released for commercial use, makes available the ruggedness and exceptional accuracy of the vibrating reed frequency meter. It measures specific bands such as 760-840 cps or 1140-1260 cps.

Again, J-B-T engineers have extended the useful range of the vibrating reed frequency meter—through use of a simple, practical electronic circuit. A vacuum tube multivibrator divides the incoming frequency by the proper integer, and shows the result on the widely used standard 400 cycle meter.

Harmonics of accidental frequencies or unusual wave form do not affect the response where the speed of the inverter or other frequency source is in the approximate range being measured.

Model 39-VTF, Laboratory Type, not shown, has an input impedance of 500,000 ohms, and uses regular line current for power supply. This model, through use of a multiplier switch, measures frequencies 1, 2, 3, 4, 6 and 9 times the basic range of 380-420 cycles.

Check These Features:

EXTREME ACCURACY . . . within 0.25% of frequency measured.

PERMANENT ACCURACY . . . calibrated at factory — no subsequent calibration or standardization required at any time.

STABILITY . . . no temperature drift after initial 30 second warm-up period. Accuracy is independent of line voltage variation. No voltage regulator, external or internal, is required.

BURN-OUT PROOF . . . no protection needed against accidental frequencies above the range being measured.

SIMPLE — LIGHTWEIGHT — COMPACT . . . only 3 tubes—6N7 multivibrator, 6V6 amplifier, 6X5 rectifier. Weighs only 6 lbs. . . . electronic unit 5½" x 6" x 4⅝": meter meets JAN-I-6 mounting dimensions for 3½" instruments.

20 WATT POWER CONSUMPTION . . . derived from frequency source being measured.

J-B-T

(Manufactured under Triplett Patents and/or Patents Pending) 3-JBT-5

J-B-T INSTRUMENTS, INC.

439 CHAPEL STREET • NEW HAVEN 8, CONNECTICUT

largely a cut-and-try proposition, with apparently conflicting results in some cases, until about 1940, when the a.c. network analyzer and the differential analyzer were used to solve the equation between frequency, inertia, and acceleration as applied to various types of power systems and various types of regulators, governors, and controllers. Controls for speed, voltage, and power were found to operate like electrical amplifiers, and this permitted a better understanding of the effects of time delay, rate of change, and rate of operation. One outstanding result of such analyses was the discovery that on systems of poor stability characteristics, the delay in correction must either be very short or very long.

Effect of Time Delay

A time lag equal to one half the natural period of oscillation causes the greatest tendency to produce instability. A time lag of one half the natural period of oscillation is equivalent to a phase shift of 180 deg., which is the maximum possible in any amplifying device. For instance, if the power system is undergoing a heavy oscillation over a tie line to another system, a time delay of 180 deg. would result in increasing turbine output at the time when the instantaneous speed of the system is increasing and would cause a still more violent oscillation. Most control devices have an inherent mechanical delay or phase shift equivalent to from 90 to 180 deg. Throttle opening on a turbine equipped with automatic load control is proportional to the cumulative total of one or more control impulses sent out by the controller which compares actual power in the tie line against the tie line schedule. This summation or integration produces a phase shift of perhaps 90 deg. or more. From these considerations, it is apparent that the inertia and damping characteristics of the power system must be given much consideration in designing and operating automatic control devices. Best performance is provided by using little time delay and a high rate of correction. Time delays in governors, voltage regulators, telemeters, and load controllers tend to pyramid and cause instability.

Much of the poor performance from even the most careful manual control results from lack of coordination between time delay and rate of

SAFETY SERVICE SIMPLICITY . . .

. . . watchwords of TIPS TOOL designers

The dead end Strain Carrier illustrated here is a typical example of the simplicity, safety and serviceability of all Tips Hot Line Tools.

This tool was designed to simplify the replacing of damaged dead end insulators on low voltage, light construction transmission lines without interrupting service. It is so simple that insulator changes have been made with it in ten minutes from start to finish. It is completely safe because it is easily applied at a safe distance from conductors. It is light weight but sturdy and serviceable and it can be applied to pole or cross arm dead ends even where space is limited.

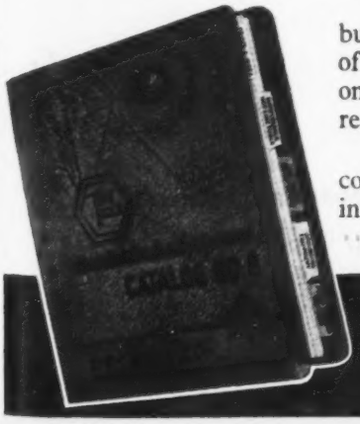
For the most part, this device was the brain child of Tips Tool Design Engineers, but it followed the usual development procedures typical of all Tips Tools. It was born of necessity and developed by improving on older ideas and combining them with new ones. Many tests, field trials and alterations were made before the final masterpiece was ready for production.

Our point is simply this—All hot line tools which bear the Tips Tool trademark are completely dependable because they are designed by experts who demand the ultimate in simplicity, safety and serviceability.

"THERE'S NOTHING TOO GOOD WHERE LIFE IS AT STAKE"

Consult this Tips Tool Catalog of Electrical Live Line Equipment for detailed information on the selection of tools and the methods for doing a variety of hot line maintenance jobs. It has sixteen pages of "how to do it" information on twenty-four different repair jobs.

If you do not have a copy or one of our Master Catalogs—where the same information is available—send for yours today.



TIPS TOOLS

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC INDUSTRIES

Scovill Tube News

Vol. 3 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 1

Hints for Controlling Tube Corrosion

An important part of Scovill service to condenser and heat exchanger tube users is practical aid in providing protection against troubles which cannot be foreseen at the time of installation.

This service is furnished in several ways — through personal calls by our engineers, through literature such as the Scovill Condenser Tube Booklet, and through the suggestions, like the following, given in Scovill Tube News, published regularly in this magazine.

WHAT TO DO

1. Select the right tube alloy for the job. Scovill *Service in Metals* can help you. A well-equipped and competently-staffed metallurgical and chemical laboratory is available for this purpose.

2. Install tubes carefully, avoiding undue stressing of the metal. Scovill *Service in Men* will help you here, and you can also obtain valuable information on proper installation practice from Scovill *Service in Manuals*.

3. Maintain streamline design at inlet ends of tubes.

4. Provide adequate support for tubes between tube sheets.

5. Eliminate, insofar as possible, turbulent flow of circulating water as the result of obstructions in the water box, improperly-aligned pump impeller, abrupt change in direction of water flow, etc.

OTHER PRECAUTIONS

1. Don't neglect adequate screening of the circulating water.
2. Don't allow cracks, crevices or other recessed openings between tubes and tube sheets, support plates, baffles, etc.
3. Don't permit air to become entrained with circulating water.
4. Clean tubes periodically, particularly if harmful deposits enter and lodge in tubes.
5. Don't overlook possible hot spots or other local overheating of tubes, due to direct impingement of hot gases, vapors, etc., or heavy deposits of scale, etc

Scovill Seamless Condenser Tubes

From raw material to finished product, each step in the manufacture of Scovill Seamless Condenser Tubes is performed on modern machines and equipment by careful, skilled operators. Process inspection, a rigid finish inspection and constant metallurgical supervision are all an integral part of the manufacturing procedure.

That is the reason for the uniform high quality of Scovill Tubes. That is the reason for enviable service records of Scovill Tubes in the field.

But Scovill interest in condenser tubes goes far beyond their manufacture. Scovill has pioneered in the study of condenser tube corrosion and, of more importance, in ways and means of combating corrosion so that maximum tube life may be assured under any particular service conditions. Scovill engineers are well qualified to study your particular problems and to offer suggestions for overcoming them. Scovill engineers are competent through training and experience to make field inspections of condenser tube installations followed by recommendations and suggestions for improving tube life. Wherever necessary, such inspection and examination can be supplemented by studies of individual corrosion problems in our metallurgical and chemical laboratories.

Thus, Scovill is ready to meet your condenser tube requirements by manufacturing tubes in a complete range of sizes and alloys and, in addition to this *Service in Metals*, also offers *Service in Men* and *Service in Manuals*.

For further demonstration of *Service in Manuals*, including more detailed discussion of the Do's and Don't's mentioned above, write for a free copy of "Condenser Tube Booklet", addressing Scovill Manufacturing Company, 24 Mill Street, Waterbury 91, Conn.

THIS IS NUMBER FOURTEEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

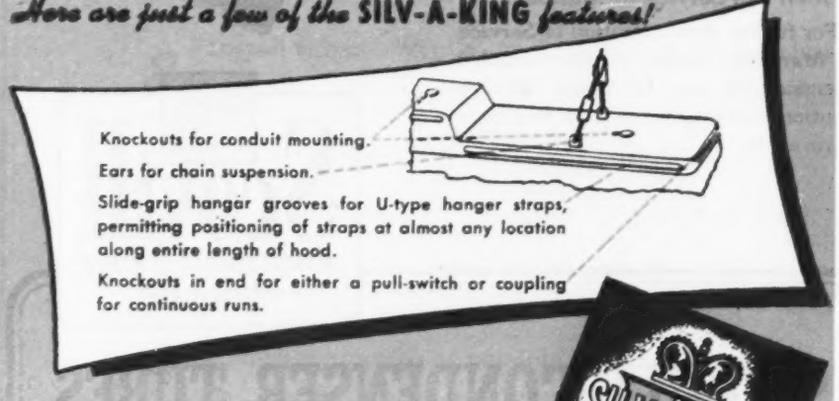
Service in Manuals... Service in Metals... Service in Men

SILV-A-KING
PORCELAIN
ENAMELED
FLUORESCENT UNITS

SPECIFICATION
INDUSTRIAL UNIT
Tested and Certified by
RLM Standard Institute

For quality, adaptability, and economy in fluorescent lighting, ask for the Silv-A-King "Specification" unit. Here's a fluorescent assembly with important, exclusive features of design and construction—at a price no greater than that of most ordinary units! Detailed technical information is available on request. Write today for Bulletin No. 44 FS.

Here are just a few of the SILV-A-KING *features!*


Knockouts for conduit mounting.
Ears for chain suspension.
Slide-grip hangar grooves for U-type hanger straps, permitting positioning of straps at almost any location along entire length of hood.
Knockouts in end for either a pull-switch or coupling for continuous runs.

Write for Bulletins 44FE and 44FS describing the "Economical" and "Specification" units.

SILV-A-KING LIGHTING EQUIPMENT

BRIGHT LIGHT REFLECTOR CO.
Metropolitan and Morgan Avenues • Brooklyn 6, N. Y.

correction since proper evaluation of these factors is beyond the capability of an operator.

A subsequent article will discuss the action of governors for both steam turbines and water wheels.

•

Vertical Guide Bearings

III—Heat Dissipation

By H. W. HAMM.
Designer, S. Morgan Smith Co., York, Pa.

Power loss due to friction in guide bearings of vertical waterwheels and generators was discussed in ELECTRICAL WORLD, March 3, 1945, page 119, and March 17, 1945, page 108. Dissipation of the heat produced by friction, energy loss and remedies for overheating are outlined here.

In the process of transfer of the heat from the oil film to the air the greatest resistance is encountered at the bearing housing surface. The heat transfer coefficient is therefore primarily a function of bearing size and the characteristics of the air surrounding the bearing. For oil ring bearings this coefficient has been found experimentally by Karelitz (see Reference 3)* and the following formula (see Reference 4) developed from it.

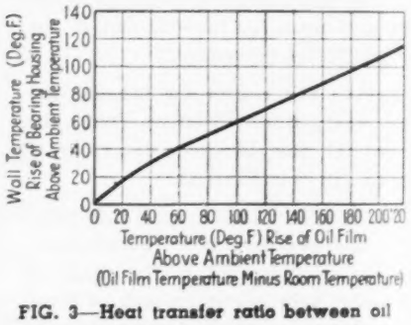


FIG. 3—Heat transfer ratio between oil film and bearing housing (see Ref. 1)

$$H_2 = 1.37\, k v^{0.5} A^{0.5} \Delta T \qquad (5)$$

where

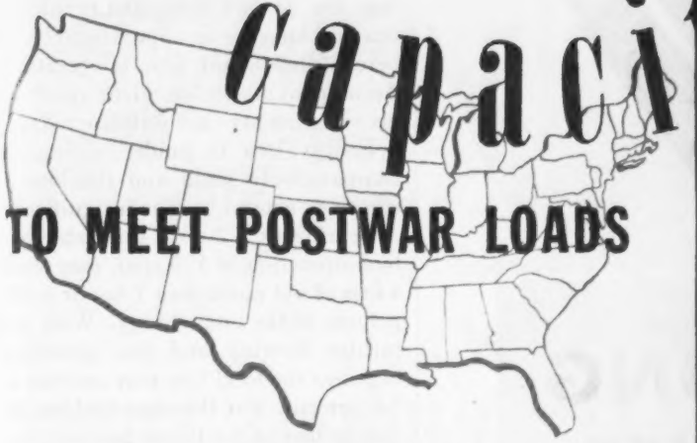
H_2 = Heat transfer in B.t.u. per hour
k = Thermal conductivity of air in B.t.u./hr./sq. ft./ deg. F./ft.
at 32 deg. F., $k = 0.014$
at 70 deg. F., $k = 0.015$
at 212 deg. F., $k = 0.0183$
v = Air velocity in feet per hour
A = Surface area of bearing housing in square feet
ΔT = Temperature difference between surface of housing and air in degrees, see graph.

This formula applies to oil ring bearings with conventional surface finish. With no other data available, it

* Equations, illustrations and references are numbered consecutively for the series of three articles. References are listed at the end of each article.

flexible capacity

TO MEET POSTWAR LOADS



. . . with the help of

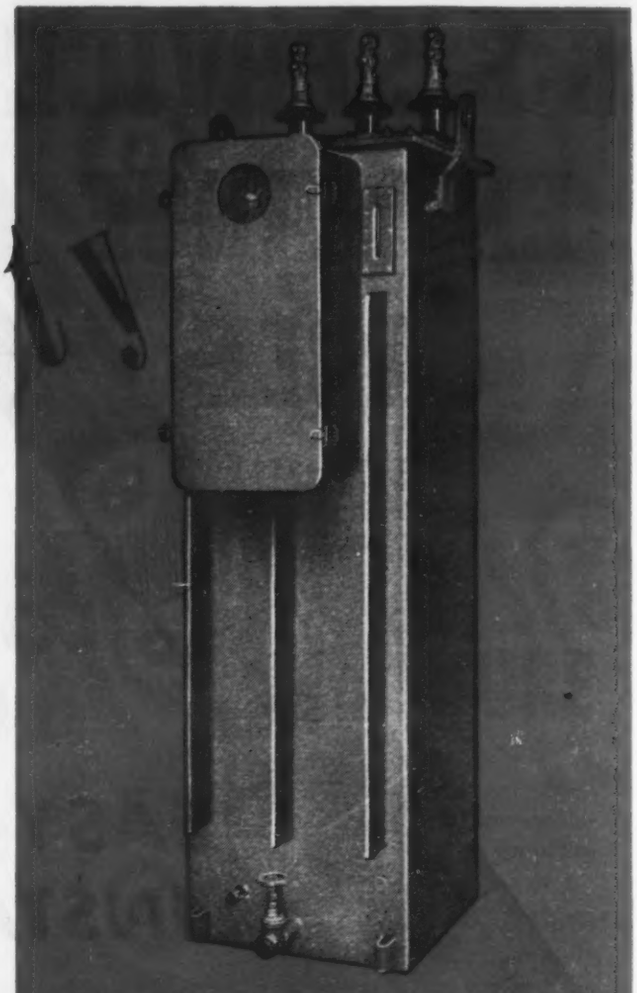
Westinghouse Voltage Regulators

Greater domestic loads and sudden population shifts will create fluctuating postwar power demands on available capacities all over the nation. These shifting loads can be met more easily—frequently without altering generating or transmission facilities—by proper and adequate use of voltage regulators.

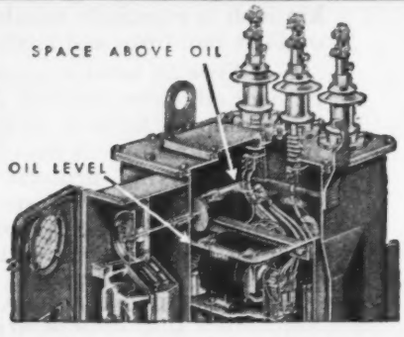
Westinghouse regulators make possible close control of voltage at low cost. New load problems can be solved quickly and flexibly, often eliminating extra lines and new generators.

Westinghouse feeder regulators meet every type of power application . . . step-type regulators for power and transmission lines: liquid-cooled induction feeder-type for outdoor and indoor use; air-cooled for indoor applications. Sturdy, simplified construction reduces maintenance, prolongs life.

When you compare your capacity with your probable future loads, consider the application of voltage regulators before you expand existing lines or add new generators. Consult your nearest Westinghouse office, or write Westinghouse Electric & Manufacturing Co., P. O. Box 868, Pittsburgh 30, Pa. J-10267



Type SU induction feeder voltage regulator for indoor or outdoor service. New regulating relay eliminates delicate pivots, pins, springs, and assures long life. Integral worm shaft construction, tapered roller bearings and dynamic braking mean high service continuity . . . entire operating mechanism is submerged in insulating oil.



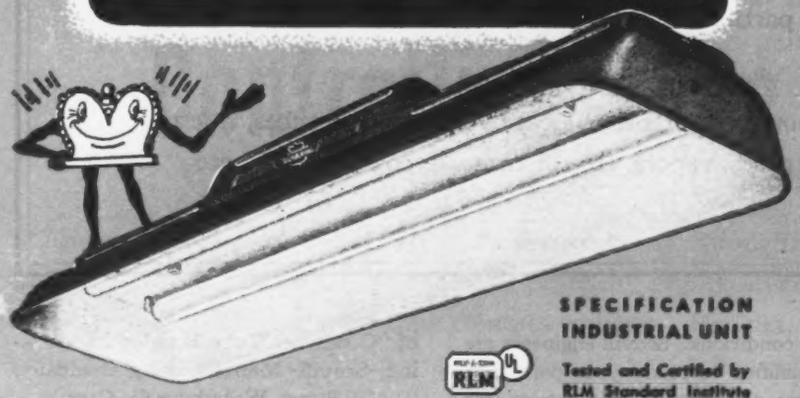
Another Westinghouse exclusive! "Sealedaire" construction provides extra protection against entrance of moisture, eliminates high oil acidity, and prevents formation of explosive gases.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

VOLTAGE REGULATORS

SILV-A-KING
PORCELAIN
ENAMELED
FLUORESCENT UNITS



SPECIFICATION
INDUSTRIAL UNIT

Tested and Certified by
RLM Standard Institute

For quality, adaptability, and economy in fluorescent lighting, ask for the Silv-A-King "Specification" unit. Here's a fluorescent assembly with important, exclusive features of design and construction—at a price no greater than that of most ordinary units! Detailed technical information is available on request. Write today for Bulletin No. 44 FS.

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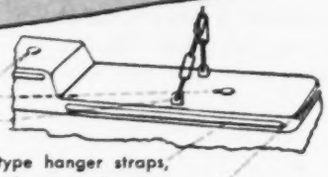

Knockouts for conduit mounting.

Ears for chain suspension.

Slide-grip hangar grooves for U-type hanger straps, permitting positioning of straps at almost any location along entire length of hood.

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By H. W. HAMM,
Designer, S. Morgan Smith Co., York, Pa.

Power loss due to friction in guide bearings of vertical waterwheels and generators was discussed in ELECTRICAL WORLD, March 3, 1945, page 119, and March 17, 1945, page 108. Dissipation of the heat produced by friction, energy loss and remedies for overheating are outlined here.

In the process of transfer of the heat from the oil film to the air the greatest resistance is encountered at the bearing housing surface. The heat transfer coefficient is therefore primarily a function of bearing size and the characteristics of the air surrounding the bearing. For oil ring bearings this coefficient has been found experimentally by Karelitz (see Reference 3)* and the following formula (see Reference 4) developed from it.

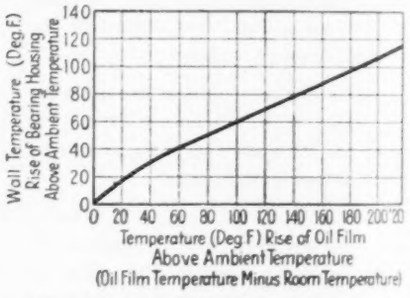


FIG. 3—Heat transfer ratio between oil film and bearing housing (see Ref. 1)

$$H_2 = 1.37\, k v^{0.5} A^{0.5} \Delta T \qquad (5)$$

where

H_2 = Heat transfer in B.t.u. per hour
k = Thermal conductivity of air in B.t.u./hr./sq. ft./ deg. F./ft.
at 32 deg. F., $k = 0.014$
at 70 deg. F., $k = 0.015$
at 212 deg. F., $k = 0.0183$
v = Air velocity in feet per hour
A = Surface area of bearing housing in square feet
ΔT = Temperature difference between surface of housing and air in degrees, see graph.

This formula applies to oil ring bearings with conventional surface finish. With no other data available, it

* Equations, illustrations and references are numbered consecutively for the series of three articles. References are listed at the end of each article.

flexible capacity!

TO MEET POSTWAR LOADS

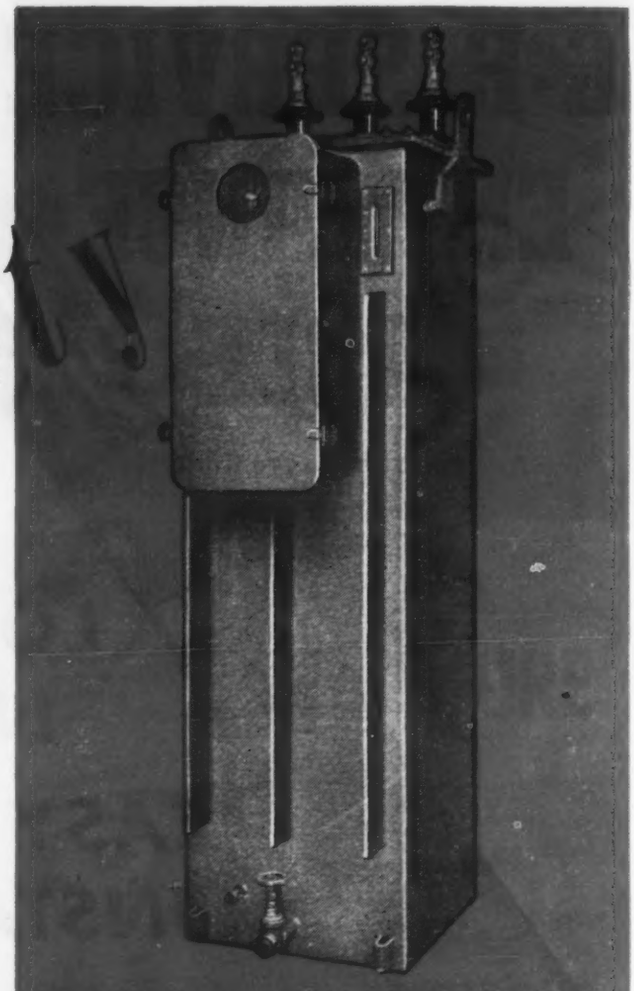
. . . with the help of Westinghouse Voltage Regulators

Greater domestic loads and sudden population shifts will create fluctuating postwar power demands on available capacities all over the nation. These shifting loads can be met more easily—frequently without altering generating or transmission facilities—by proper and adequate use of voltage regulators.

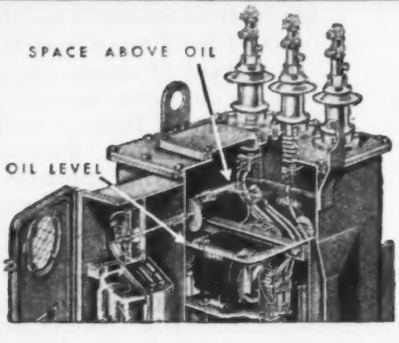
Westinghouse regulators make possible close control of voltage at low cost. New load problems can be solved quickly and flexibly, often eliminating extra lines and new generators.

Westinghouse feeder regulators meet every type of power application . . . step-type regulators for power and transmission lines: liquid-cooled induction feeder-type for outdoor and indoor use; air-cooled for indoor applications. Sturdy, simplified construction reduces maintenance, prolongs life.

When you compare your capacity with your probable future loads, consider the application of voltage regulators before you expand existing lines or add new generators. Consult your nearest Westinghouse office, or write Westinghouse Electric & Manufacturing Co., P. O. Box 868, Pittsburgh 30, Pa. J-10267



Type SU induction feeder voltage regulator for indoor or outdoor service. New regulating relay eliminates delicate pivots, pins, springs, and assures long life. Integral worm shaft construction, tapered roller bearings and dynamic braking mean high service continuity . . . entire operating mechanism is submerged in insulating oil.



Another Westinghouse exclusive! "Sealedaire" construction provides extra protection against entrance of moisture, eliminates high oil acidity, and prevents formation of explosive gases.

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VOLTAGE REGULATORS

G-E SERVICE ENTRANCE CABLE

(TYPE SE)

This sturdy, tough cable is available in sizes 12 to 2. Cable assemblies consist of one or more Type R insulated conductors and a concentrically-applied stranded bare conductor. It is designed for use from entrance caps to meter equipment and for use in range circuits. It is ideal for service entrance wiring on homes, stores, garages and small buildings of all kinds. It is especially suitable, too, for service wiring on farm buildings and farm meter poles.

G-E Type SE service entrance cable is flexible—can be bent edgewise without damaging the conductors. It is compact, light in weight and requires only the simplest of fittings. A heavy, watertight, weatherproof over-all covering protects the conductors. Similar cable is available with steel armor under the outer covering. G-E Type SD cable is also offered for overhead use from pole to building.

FOR FURTHER INFORMATION see the nearest G-E Merchandise Distributor or write to Section C352-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

BUY WAR BONDS AND KEEP THEM

GENERAL ELECTRIC

may serve with sufficient accuracy for the self-contained vertical guide bearing. The smallest encountered air stream velocity is v=5,000 ft./hr. for natural convection—i.e. for the upward flow of air due to change of density with rising temperature (see References 3 and 5). Karelitz found that the surface temperature of the bearing housing is approximately 20 percent below oil film temperature. Accompanying graph gives result of his experiments (see Reference 3).

Energy loss in guide bearings is comparatively small and the loss in efficiency caused by it is insignificant. A bearing of a 20,000 hp. water turbine operating at 175 rpm. may show a loss of not more than 7 hp. or 0.035 percent of the total energy. With one turbine bearing and two generator bearings the total loss may amount to 0.1 percent. For the same turbine the energy loss in the thrust bearing may amount to many times this figure.

Remedies for Overheating

Because of the small amount of friction produced, guide bearings seldom give trouble by overheating. Most of the trouble encountered in guide bearings is due to neglect of bearing surfaces, to dirty lubricant or obstructions in the piping. If these are not the causes for overheating the difficulty may be remedied by the following measures:

1. Change of oil viscosity. Because of the different principle of operation, the oil viscosity of a guide bearing can be much lower than that of a thrust bearing and sleeve bearings operating under heavy load. Lowering of the viscosity by using a lighter oil will reduce the friction energy.

2. Reducing the length of the bearing sleeve will have the same result.

3. Likewise will an increase in bearing clearance cause a reduction of friction losses.

4. Introduction or increase of a forced draft of air will increase the cooling capacity of a bearing and thus keep the temperature down.

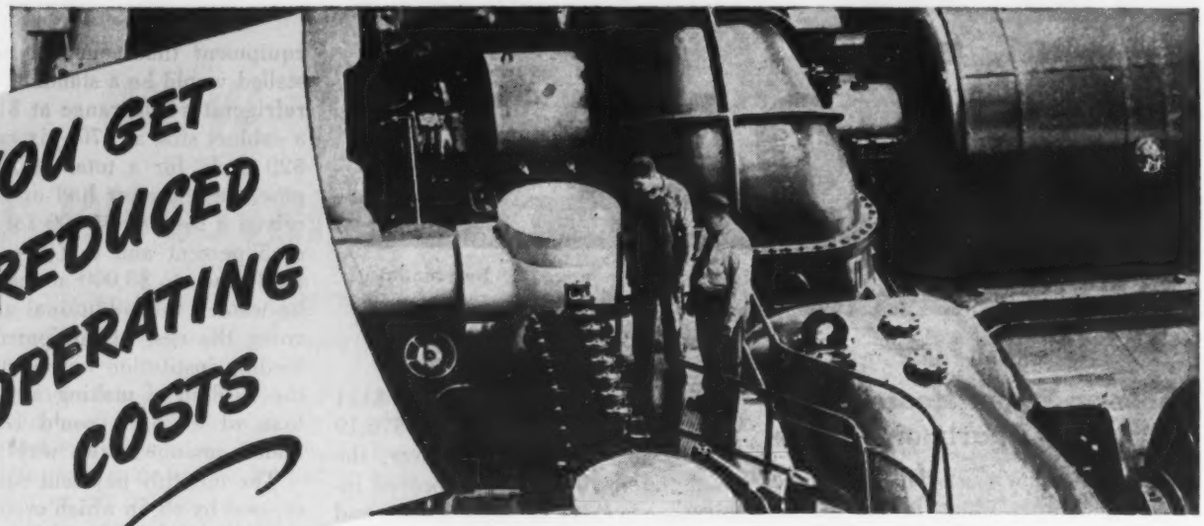
5. If introduction of these four measures is insufficient, cooling of the bearing or the oil by circulating water will be necessary.

References in this article:

3. Performance of Oil Ring Bearings: G. B. Karelitz; *A.S.M.E. Transactions*, 1930, APM-52-5.

4. Computations for Cooling by Oil-Hydraulic Means; H. W. Hamm; *Product Engineering*, March 1944.

5. Heat Transmission: W. H. McAdams; McGraw-Hill Book Co., New York, 1942, page 238.

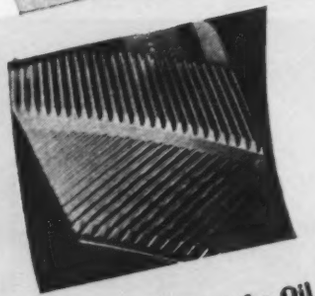


YOU GET REDUCED OPERATING COSTS

. . . with *new* SHELL TURBINE CLEANING PROCEDURE

HERE'S WHY . . .

1 Rust, scale and metal chips quickly contaminate new oil. Shown is duplex strainer and 5 minutes' catch on improperly cleaned turbine.



2 When Shell Turbo Oil is used . . . following Shell Turbine Cleaning Procedure . . . gears remain clean and peak efficiency results.

YOU WIN from the start when you follow the new Shell Turbine Cleaning Procedure. It has been scientifically developed to assure thoroughness; at the same time, it simplifies and speeds each step from "Stop" to "Start."

Take solvent cleaning, the first step: Here Shell Turbo Cleaner takes the place of hours of tough manual work. It dissolves oil deterioration products—sludge, lacquers and the like; helps remove loose rust and other solid matter. In addition, since it has good rust-preventive properties, it protects the system against rust.

Following the cleaner comes a *displacement* oil, together with final draining and inspection. And that's all!

See how simple, how completely foolproof the procedure is! Properly carried out, it will pay for itself in increased oil life, less frequent shutdowns and better over-all operation.

For complete information, phone, wire or call Shell Oil Company, Inc., 50 West 50th Street, New York City 20, New York, or 100 Bush Street, San Francisco 6, California.

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LOAD SERVICING

Commercial
Industrial

Residential
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Electric Water Heater for Apartment House

High summer cost of operation and inadequate hot water in the winter heating season led the Spokane, Portland & Seattle Railway Co., operator of an apartment house in Vancouver, Wash., to disconnect the hot water boiler from a coal fired combination heating plant and install electric heaters in the hot water boiler. A check on coal consumption during summer months when the heating plant had to be operated for hot water only, showed a consumption of 600 lb. of coal a day and a monthly cost of $114.

The piping between the hot water boiler and the heating plant was removed and two 10-kw. thermostatically controlled electric heaters installed in the head of the boiler as illustrated. Energy consumed for the period December 14, 1944, to January 16, 1945, was 7,774 kw.-hr., which cost the customer $76.19. Hot water consumption for the 15 apartments and 7 single rooms in the building will be less, if anything, in the summer months than during the winter month checked, so the customer figures he is saving at least the difference between the summer coal cost of $114 and the winter electric cost of $76.19 or $37.81 a month. Moreover, the combination heating plant proved inadequate to carry the dual heating and hot water load during winter months. This made tenant satisfaction an important further consideration.

•

Financing Post-War Kitchen Improvements

By JOHN FELLMAN,
Edison General Electric Appliance Co., Chicago, Ill.

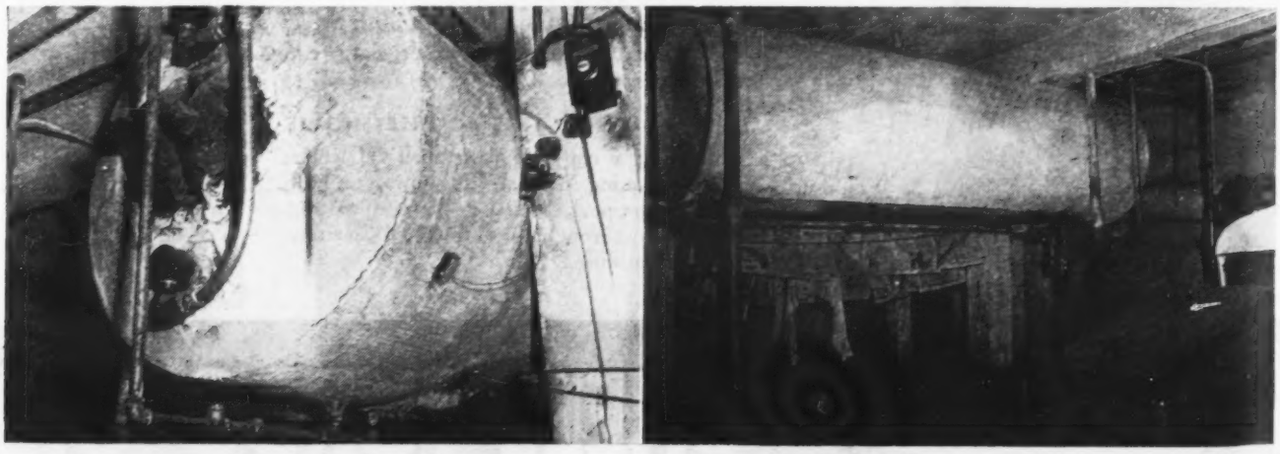
Important in determining how effective as a load builder the modern kitchen will be when the war is over is the matter of paying for it. If the sale is regarded as a straight time payment proposition as in pre-war days, the financial burden on the buyer will be a major obstacle against the idea of "package" purchase of complete kitchen equipment. But, if the modern kitchen purchase can be incorporated into the terms of home buying that obstacle will disappear.

For example, in remodeling an old home valued at $5,000 the kitchen equipment that could be wisely installed would be a standard electrical refrigerator and range at $140 each; a cabinet sink at $70; six cabinets at $20 each, for a total of $470. Suppose the borrower had originally received a loan of $4,000 for 15 years at 5 percent and that the loan was paid down to $3,000 at the time that he wanted this additional advance to cover the cost of equipment. If the lending institution were convinced of the wisdom of making an additional loan of $475, it could collect this added amount in two ways.

The monthly payment could be increased by $5, in which event the loan would be paid off in the originally stipulated time. The other alternative would be to extend the period of the loan and leave the amount of the monthly payment unchanged, which would mean it would take 18 months longer to pay the loan out completely.

Of course, the borrower could get this equipment financed through a commercial credit establishment. In this case, figured on prewar contracts before Regulation W was instituted, the borrower would have to make a 10 percent down payment and repay the balance, plus a 6 percent charge collected in advance, within a period of two years. This would mean a monthly payment of $19.70. The difference between this and the $5 payment to the association of almost $15 per month in the budget of a person owning a $5,000 home could very well be the deciding factor as to whether or not the kitchen could be modernized. This larger payment might be more than he could handle.

Where the cost of kitchen improve-



TWO 10-KW. IMMERSION HEATERS installed in 550-gal. apartment house hot water boiler saves $38 per month over coal stoker operation of combined heating and hot water boiler. Tenant satisfaction was a further consideration

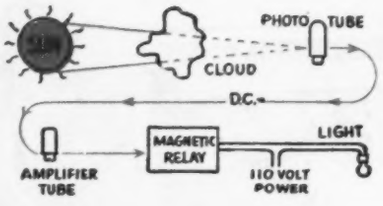
HOW WOULD YOU USE THESE 3 INDUSTRIAL ELECTRONIC SERVANTS?

UNITED CINEPHONE CORPORATION, of Torrington, Conn., has developed three simple electronic devices that almost every industrial plant can—and some day will—use to advantage

The Sun-Switch turns factory or office lights off or on *automatically* when outdoor light rises or falls, avoiding poor work caused by bad visibility or eye fatigue.

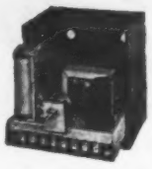
It can also be used to switch on or off aircraft beacons, and outdoor lighting of all kinds.

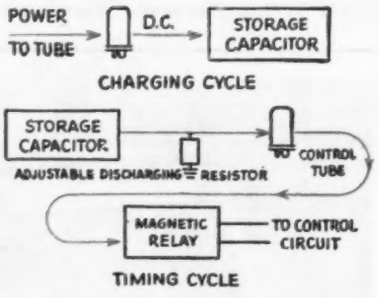
What Is It? The "Sun-Switch" is a phototube device, in which a change of light is used to operate a magnetic switch. The tubes are: an RCA type 930 phototube followed by an RCA 6SJ7 detector-amplifier and an RCA 6SN7-GT amplifier.



How It Works: When sufficient light strikes the phototube, its output, amplified by the following tubes, operates a magnetic relay which turns *off* the lights. When the light striking the phototube decreases to a preset level, the lights are switched on again. The light-level range is adjustable.

Electronic Timer: The United Cinephone electronic timer accurately time-controls operations of machine tools, molding presses, ovens, electronic heaters, photographic printing, etc. Two or more timers can be connected to provide automatic sequences. Time interval is adjustable from 0.05 to 100 seconds. Avoids human error. Easy to set; wide range; no resetting needed; hundreds of thousands of operations with virtually no maintenance.

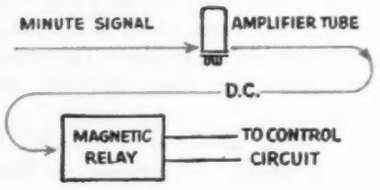




How It Works: An RCA 6J5 amplifier tube is used. It first acts as a rectifier, supplying d-c to a storage capacitor. When the time interval is "initiated" by the initiating switch, the stored energy is dissipated through an adjustable resistor. When the voltage across the storage capacitor thus drops to a preselected value, the tube supplies current to operate a sensitive magnetic relay.

Electronic Switch: For reliable switching where a tiny current can replace heavy currents or mechanical devices. Only 3/1,000,000 ampere will actuate the electron tube which operates the relay.

The small current replaces heavy currents required in some chemical processes or machine or gauging operations where a relay is actuated directly. Excellent for floatless control of liquid levels, pressureless limit-switching, and to replace clumsy, slow, leverage systems. Operates up to 800 times per minute; has exceptionally long life and low maintenance. Widely used in industry.



How It Works: A tiny current flowing through the external circuit and through a very high resistance (1 million ohms or more) develops enough voltage across the resistance to control the current flow through an RCA 6J5 detector-amplifier tube. The tube current operates a magnetic relay.

The magic brain that powers these devices is in each case an RCA Electron Tube

Have you a problem?

Industrial electronics, already widely accepted, is destined to play a giant's role tomorrow. If you suspect that measuring, counting, weighing, sorting, controlling, heating, or some other mechanical or manual operation in your plant can be more accurately, efficiently, or profitably performed "the electronic way," you are probably right. Why not write to us, stating your problem, so we can refer you to the equipment manufacturer best fitted to serve you?

Meantime we will gladly mail you our 32-page, illustrated, free booklet "Electrons in Action at RCA," if you will write to RCA, Commercial Engineering Section, Dept. 62-53, Harrison, N. J.

THE FOUNTAIN-HEAD OF MODERN TUBE DEVELOPMENT IS RCA

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RCA

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ments is included in the regular home loan the increase in value to the building makes it a sound proposition to the mortgage holder, and the long-term payments at the lower rate of interest place no undue strain on the family budget of the borrower, where other conditions warrant such an extension of credit.

•

Free Gas Wouldn't Make Engine Pay

Simple arithmetic convinced an industrial customer on the lines of Northwestern Electric Co., Portland, Ore., that he would be money ahead to abandon operation of a gas engine-driven air compressor using city gas in favor of electric drive, even at more than three times the "fuel" cost. Facts were these: old equipment consisted of a 60-hp. Buda gasoline engine driving a 6-cylinder, two stage, 210 cu. ft. air-cooled air compressor. The carburetor had been rebuilt and the engine converted to burn 550 B.t.u. city gas. Cost of gas was 15 cents per hour, or about $35 per month. However, it required one-half the time of an $11.40 a day man to watch the water, clean spark plugs and to operate the engine. This made total operating cost, $177.50 per month.

A 50 hp. motor was installed to drive a similar compressor as illustrated. Cost of operation averages 50 cents per hour or about $100 per month. Thus, even at more than three times the fuel rate, the customer is saving $77.50 per month and he couldn't even afford to operate the engine if gas was free.

This job was engineered by D. O. Bergy, utilization engineer for Northwestern Electric Co.

CITY GAS-OPERATED ENGINE driving air compressor is displaced by electric drive at saving of $77.50 per month. Gas engine costs were: fuel, $35; labor $142.50; total $177.50 per month. Electric cost: $100 a month for power; no labor

•

Vegetable Wash Water Ultra-Violet Purified

Washing and cooling vegetables as they are packed for market takes a lot of water. To filter and recirculate the water for repeated use is not good because the bacteria count rises so rapidly and so high as to be dangerous. And to use the water only once and replace it with fresh is in many cases uneconomical. Solution to this problem, according to L. B. Veloz, Westinghouse Sterilamp specialist, in a recent paper to the North Atlantic Section, American Society of Agricultural Engineers, is to purify the water continously by exposure to ultra-violet radiation. One way to do this is to install Sterilamps a couple of inches above the surface of the water in a shallow trough on the top of the washing machine as shown in the illustration.

ULTRA-VIOLET LAMPS installed in shallow purification tank on top of washing machine allow washing and cooling water to be used repeatedly.

"LET ME KNOW BY WIRE!" "In answer to your wire!" You hear it everywhere, and this use of *wire* for *telegram* is tribute to the almost incredible network of wires by which Western Union serves the nation. And few facts in turn, speak so eloquently of the dependability of VINYLITE plastic wire and cable insulation as its widespread adoption by Western Union.

Among many applications in its offices, this great communications leader uses instrument wire with VINYLITE plastic primary insulation, and no outer covering. Such wire forms the connections on distributing frames and switchboards. It is used on stationary apparatus and carriages in motion, and has better heat resistance than former materials. But wherever used, inside or out, Western Union has found the thin-wall construction of VINYLITE plastic insulation of outstanding value. Its extreme flexibility, resistance to aging, flame, moisture, abrasion, and most chemicals bring new standards of life and performance.

Specify VINYLITE plastic insulation for your own applications. Write Department 28 for your copy of "VINYLITE Plastics for Wire and Cable Insulation."

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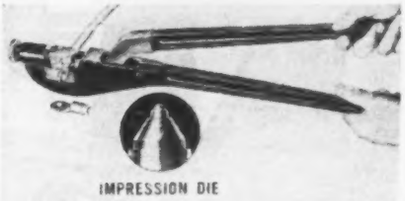
Connector Tool



"Hytool MY 28": accommodates connectors for cable from No. 8 to 250 Mcm.; wt. 6½ lb. **Burndy Engineering Co.**, 107 Bruckner Blvd., New York 54, N. Y.

Universal hand tool for installing both copper and aluminum connectors on following size cable—aircraft cable, No. 8 to 4/0; U. S. N. cable, No. 23 to 250 Mcm.; commercial cable, No. 8 to 250 Mcm.; welding cable, No. 8 to 4/0. Single, stepped impression die makes tool self-contained. Holding-die adjustment is made by a thumb screw, and each setting is determined by a graduated scale on the head of the tool.

•

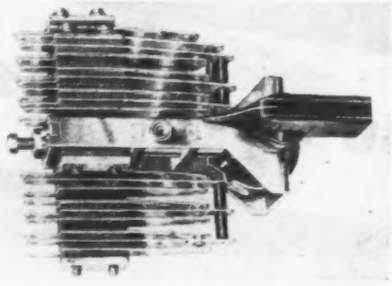
Test Instrument

Model "695" type "11" test instrument: decibels and volts; test leads; size 5½ in. by 3¾ in. by 3⅛ in. **Weston Electrical Instrument Corp.**, 617 Frelinghuysen Ave., Newark 5, N. J.

Compact, portable instrument, which is essentially a rectifier type voltmeter, has decibel and voltage scales. Said to be applicable for power level measurements in sound equipment and radio receivers, as well as a.c. voltages up to 200 volts. Unit is reported to have constant impedance of 20,000 ohms. When connected across a sound line, ranges can be shifted without varying line impedance. Eleven db. ranges are provided, from —4 to 36 db. at zero on the db. scale. Self-contained condenser which is cut-in through a separate pin-jack is provided for blocking d.c. components. Instrument is calibrated for 500 ohm lines with zero level at 6 milliwatts or 1.732 volts and a chart is supplied giving interpolation values on lines other than 500 ohms—from 5 to 10,000 ohms at 6 milliwatts level.

•

Turn Switch



Series "6300" turn switch: 2 or 3 position. **Donald P. Mossman, Inc.**, 612 N. Michigan Ave., Chicago 11, Ill.

Heavy duty, multiple circuit turn switch designed for panel mounting. Unit is available as two or three position switch and may be either locking or non-locking.

•

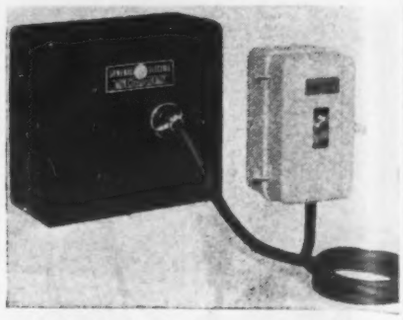
Infrared Units

Three models (60,000, 60,100, 60,200): reflectors gold plated inside; outside finish gray wrinkle; 375 watt 110-volt G-30 lamp; a.c. or d.c.; 18 ft. of cord. **Fostoria Pressed Steel Corp.**, Fostoria, Ohio.

Line of infrared units includes 3 models. No. 60-000 is a hand model which can be converted to a self-supporting unit by the addition of flexible arms and base later; No. 60-100 is self-supporting having a crowfoot base with vertical upright and adjustable clamp to fasten horizontal arm at maximum height of 24 inches; No. 60-200 has a clamp base for mounting on bench or framework. Flexible arms are said to make any position of the reflector possible.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Control



Control for barn hay driers. **General Electric Co.**, Schenectady, N. Y.

Equipment consisting of a magnetic starter, time switch, and thermostat (if required) is now available to operate 3 and 5 hp., 230-volt single phase motors. Equipment for larger and smaller motors will be available later. Start, either manually or automatically operated, is equipped with selector switch, with on, off and automatic positions. Time switch with 3 sets of riders is used to start and stop blower periodically should humidity become too high. Thermostat, when used, is inserted in the hay and cuts-in the blower to cool, maintain quality of the hay and avoid fire.

•

Motors

Slow speed motors: input rating 2 watts. **Warren Telechron Co.**, Ashland, Mass.

Slow speed, totally enclosed motors for use in timers, thermostats, oil burners, coal stokers, etc., One model has a reported speed of one revolution per hour and a companion model at speeds of from 3 to 6 revolutions per hour. Special oil gland has been built into the terminal shaft bearing. The terminal shaft is concentric with the outer case of the motor.

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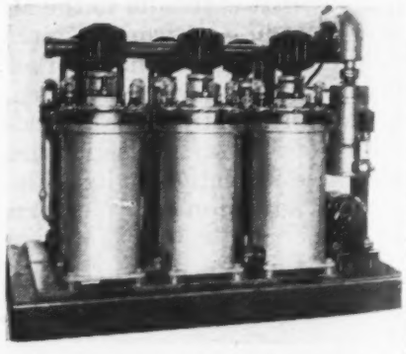
Induction Heating Unit



Mercury arc type of frequency changer: 60 or 25 cycle input; 1000 to 2000 cycle output; Cap. 250, 500 and 1000 kw. **Allis-Chalmers Mfg. Co.**, Milwaukee, Wis.

Units are designed to change 25 or 60 cycle power to 1000 to 2000 cycle power for forging, melting and metal treating applications where large masses of metal or metal parts are to be heated. Tubes are water cooled and are said to require no ventilation or air-filtering. Units are reported as quiet in operation, to have high full and partial load efficiencies, and to have low maintenance costs.

WHY?

ARE HUBBARD NO. 4-11-44 WIREHOLDERS SO STRONG

When a dead-end load is applied to a Hubbard 4-11-44 Wireholder, the first thing that happens is a close conformation to the porcelain of the Copperweld wire bail, which runs around the wire hole. This distributes a compression load over the largest possible area of the porcelain. *The metal bail carries the load,* the porcelain merely rides the bail like a saddle.

This is evident on observing the construction of the Hubbard 4-11-44. But not so well understood, is how the bail-fastening to the base stands up so well. At first glance it would seem that increased loading would simply straighten out the hooked ends of the bail and cause them to let go. By referring to the diagram it will be seen why this is not so.

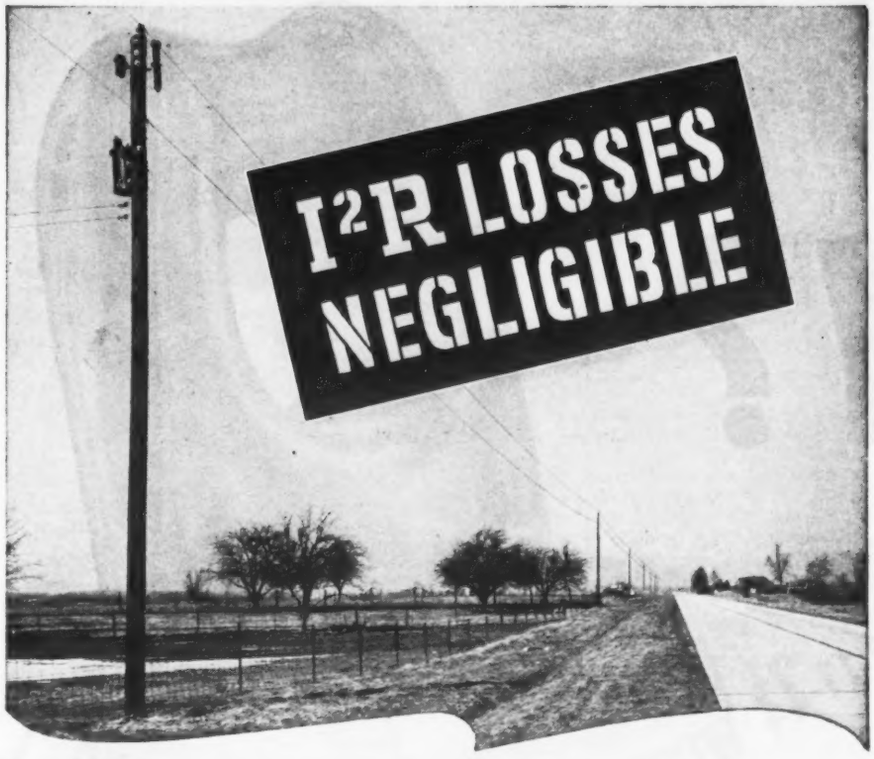
As the load is increased at "A" beyond normal strain, the base starts to "bow" up slightly at "D". Immediately the shoulders at "B" and "C" are drawn in against the bail "E", gripping it over a fairly large area, like the jaws of a vise. The harder the pull, the tighter the grip until the ultimate of the bail wire is reached.

*Tests have shown that before the bail breaks the normal mounting would long since have pulled loose. Attached to a solid beam of hard wood one Hubbard 4-11-44 Wireholder will support the weight of a light automobile.

**The full strength of any wireholder will not be developed by a poor mounting. Thin siding, soft splintery wood or loose bricks will give way under a very low strain. Avoid weak mounting.*

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND, CALIFORNIA . . . CHICAGO



Line losses on rural lines built of *Crapo* Steel Conductors are negligible compared with the overall savings made possible by these conductors.

For example: let's assume we are to build a single-phase, 6900-volt line 5 miles long with a normal load of one kilowatt per mile and 0.90 power factor. Assuming that the load is concentrated at far end of the line, the 5-kilowatt load will have a current of 0.81 amperes. The total resistance of this line built of No. 6 B.W.G. *Crapo* HTC-130 Stranded (3-wire) Steel Conductor will be 5 (miles) x 2 (conductors) x 11.29 (ohms per mile) or 112.9 ohms. The square of 0.81 amperes is 0.656 which, multiplied by 112.9 ohms, equals 74 watts.

For uniformly distributed loads the line loss is approximately two-thirds of that for concentrated loads. The I^2R loss for the line described above will be two-thirds of 74 watts or 49 watts. This means that the I^2R loss in delivering five kilowatts is only 1% of the input energy.

Actual operating experience of all REA Co-operatives for 1942 shows that the average load per mile of line was approximately one-third of a kilowatt. With a load of one-third kilowatt per mile, the I^2R loss on the 5-mile line will be only 5.4 watts. The total I^2R loss for a 24-hour day will be 0.13 kilowatts. Even at one cent a kilowatt-hour, this would mean but 0.13 of a cent per 24-hour day; approximately 47 cents per year for the 5 circuit miles, or 9.4 cents per mile per year.

Such a loss is insignificant compared with the savings of $100 to $150 per mile which have been reported where *Crapo* Steel Conductors have been used in long-span rural-line construction.

Your Post-War Plans

Consider the economical advantages of *Crapo* Steel Conductors in developing your post-war plans for extending rural lines! Complete technical information, including electrical and physical characteristics, sag and tension data, recommended construction practices, etc., will be found in our Engineering Manual, available upon request.

Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask the Graybar representative or write direct for your copy of the Manual.

INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

Crapo HTC-130 STEEL CONDUCTORS

TECHNICAL LITERATURE

Welding—Booklet "New Data on Maintenance Welding" may be procured from the Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y. Describes procedures in which welding at low temperatures of cast iron, steel, aluminum, bronze, etc. produce bonds which are machinable.

Thermostats—Seven types of thermostats are described in the 20-page booklet, Thermostatic Controls, which may be obtained from Westinghouse Electric & Mfg. Co., P. O. Box 868, Pittsburgh 30, Pa. Characteristics of each type are discussed, capacities are tabled, and cross sections, curves and drawings illustrate operation and proper mounting.

Boiler Walls—Bulletin describes principles underlying sectionally supported walls and contains illustrations showing typical temperature variations in a boiler wall and indicating the resultant expansion. Describes a means of controlling the expansion to increase boiler effectiveness. Copies may be obtained from Geo. P. Reintjes Co., 2517 Jefferson St., Kansas City, Mo.

Sales Control—Effective administrative procedures and controls in planning and carrying out sales programs are described, and the equipment used illustrated, in a 96-page book available upon request from Systems Divisions, Remington Rand, Inc., Buffalo 5, N. Y. Essential information on sales control is broken down into three divisions—master summary control of branch office operations, control of individual salesmen's performance, and individual account control. Contains information and suggestions on the simplification of operating routines.

Tubes—Specifications, ratings, maximum typical circuit conditions for transmitting triodes, mercury-vapor rectifiers, high-vacuum rectifiers, grid-control mercury-vapor rectifiers; power amplifiers, and voltage regulators are listed in a brochure by General Electronics, Inc., 1819 Broadway, New York 23, N. Y. Also contains a section on "How to Operate Mercury Vapor Rectifier Tubes."

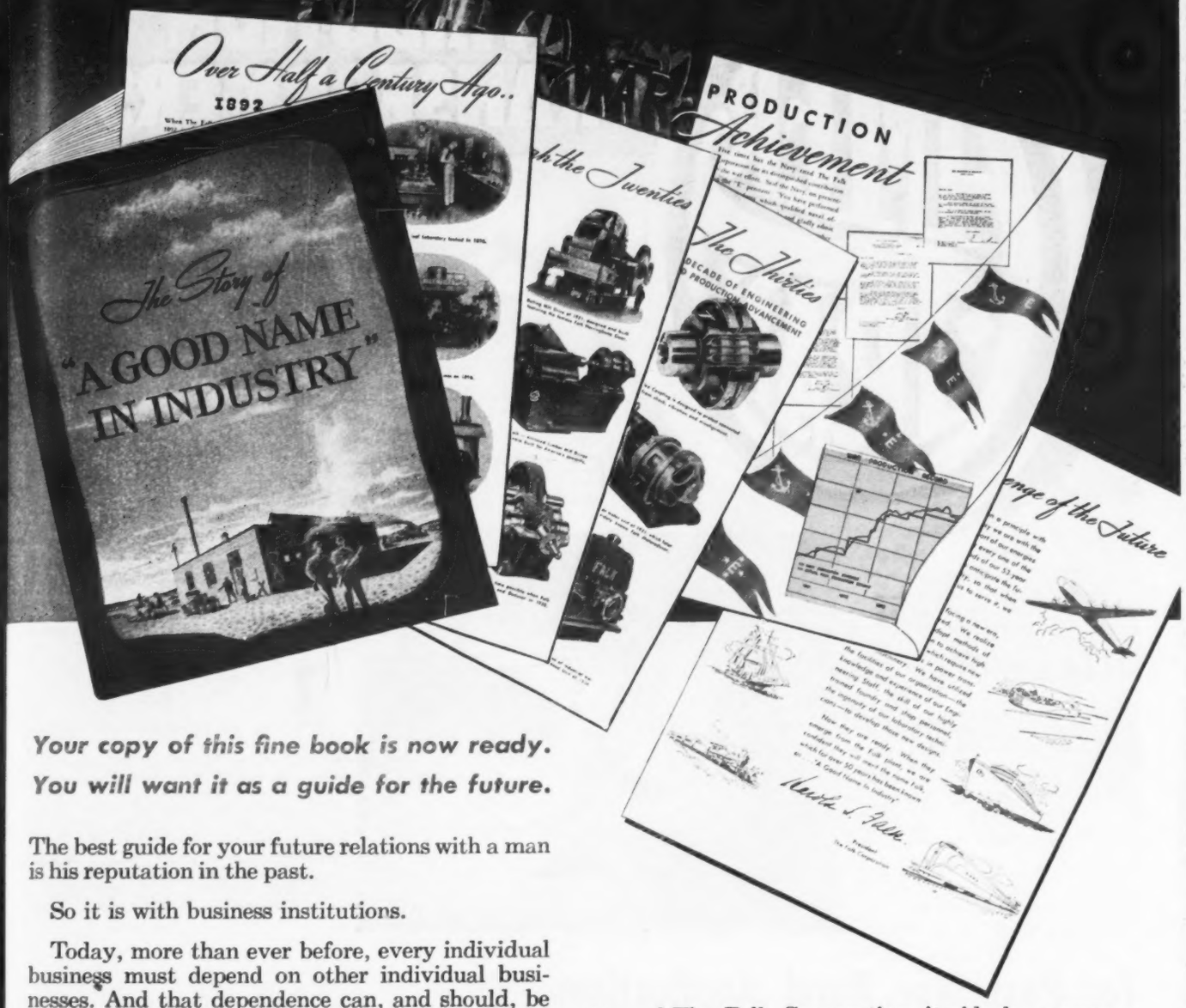
Lighting Primer—Lists many of the technical and semi-technical terms used in the lighting industry, includes a short layman's history of lighting, and an a-b-c explanation of lamps and fixtures, how they are made, sold, and distributed. Feeling that others will benefit and see the need for something similar for their own employees, Mitchell Manufacturing Co., 2525 Clybourn Ave., Chicago 14, Ill., will send a free copy to any executive writing for it.

Mica—An 86-page illustrated manual on insulating materials procurable from the Mica Insulator Co., 200 Varick St., New York 14, N. Y. Contains data in tabular form on sheet mica, built up mica, laminated plastics, varnished cloth and tapes as well as varnishes, twines and fiberglass.

Cable Operation, 1942—A joint report (L1) of committee on power distribution, association of Edison Illuminating Companies and transmission and distribution committee, Edison Electric Institute which combines the essential features of studies on cable, joint and pothead performance and the causes of troubles. Copies may be procured from Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y. at 50 cents per copy for members, $1.25 for non-members and $1.35 for foreign mailing.

Cable Joints—Bulletin CJ1 contains instructions for making hand wrapped joints with varnish cambric insulated, lead covered cables. Both single and multiple conductor cable joints are illustrated and described. Copies may be obtained from G&W Electrical Specialty Co., 7780 Dante Ave., Chicago 19, Ill.

THE PAST FORETELLS THE FUTURE



Your copy of this fine book is now ready. You will want it as a guide for the future.

The best guide for your future relations with a man is his reputation in the past.

So it is with business institutions.

Today, more than ever before, every individual business must depend on other individual businesses. And that dependence can, and should, be placed only upon those business institutions whose record of performance as to policy, product, service and general attitude has been flawless in the past.

Many new businesses exist today. Many others, old in years, have not kept young in thinking . . . and are passing from the national picture. This has been the history of business since the world began.

Yet, through all the economic changes, certain institutions have grown old in years, but have kept young in spirit and have constantly improved upon their original reason for existence.

The book illustrated above deals with the history of The Falk Corporation, its ideals, accomplishments, and plans for the future so far as those plans can now be projected.

You, too, in your effort to render a service to your industry, must of necessity have followed many of the principles set forth in this book. For that reason we believe that the book will interest you and will provide you with reasons why The Falk Corporation will be a sound source of supply for the machinery you will need to shave pennies from production costs and improve your product, in order to compete in the salesmen's war to come.

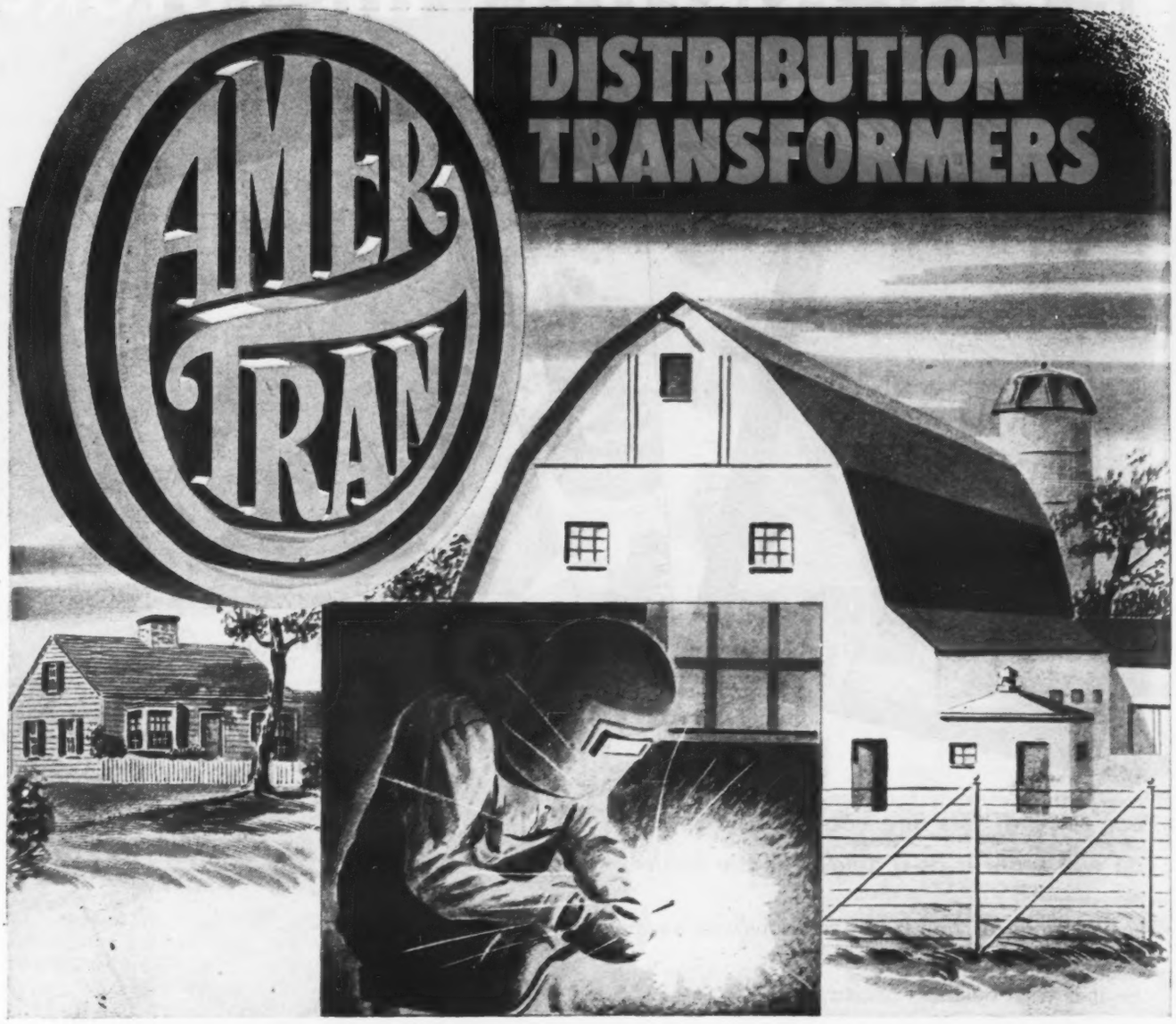
THE FALK CORPORATION, *Milwaukee 8 Wisconsin*

ALWAYS PAYS TO CONSULT **FALK** . . . A GOOD NAME IN INDUSTRY

For over fifty years Precision Manufacturers of

District offices, representatives, or distributors in principal cities.

Speed Reducers • Motoreducers • Flexible Couplings • Herringbone and Single Helical Gears • Heavy Gear Drives
Marine and Diesel Engine Gear Drives and Clutches • Steel Castings • Contract Welding and Machine Work.



For Post War Rural Applications

Two and one-half million farms now use electric power. Over three million others are considered to be prospective users of electric power. And with many rural electric power projects in prospect for the post-war period, the future of the farmer as a buyer of electrical equipment is assured. At the same time, a study of the trend toward farm mechanization and electrification during recent years indicates that much must be done to improve the transmission and distribution of power in rural areas.

New AmerTran Distribution Transformers for rural service are designed for unusual ruggedness and freedom from trouble. Such qualities are particularly required in rural electrification because of the greater distances involved, the comparative inaccessibility of installations and their exposed locations.

AMERICAN TRANSFORMER COMPANY, 178 EMMET ST., NEWARK 5, N. J.

LOOK FOR THESE ADVANTAGES IN THE NEW AMERTRAN DISTRIBUTION TRANSFORMERS

Lower Exciting Current
Increased Overload Capacity
Smaller Size • • • Lighter Weight
Improved Tank Construction
Coordinated Insulation
Improved Regulation • • • New Terminal Facilities

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK N. J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

NEWS ABOUT PEOPLE

A. S. Glasgow Promoted by San Diego Utility

A. S. Glasgow, formerly assistant superintendent of the electric distribution and transmission department of the San Diego Gas & Electric Co. has been promoted to department superintendent succeeding K. B. Ayres, whose retirement was announced recently. A graduate of Pennsylvania State University, Mr. Glasgow was employed by the San Diego utility in 1916, as the first district manager of the Oceanside territory. Prior to that time he was an engineer with the General Electric Co.

A. S. Glasgow

Filling Mr. Glasgow's former position as assistant superintendent is C. J. Nevitt. Mr. Nevitt is a graduate of the University of California and served as estimator in the engineering department from the time he entered the company in 1936 until 1941, when he was made electric distribution engineer.

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▶J. W. Owens, Jr., formerly engineer of the Carroll County Electric Cooperative Corp., has been made manager of the Consolidated Electric Cooperative Corp., at Mexico, Mo.

▶C. S. Kennedy, vice-president and general manager of the Otter Tail Power Co., Fergus Falls, Minn., since 1920, has resigned to devote his time to personal interests. The duties performed by Mr. Kennedy have been largely assigned to Cyrus G. Wright as vice-president in charge of operations. Mr. Kennedy assumed the duties of operating the company shortly after the death of its first manager, C. B. Kidder, nearly 25 years ago. Before going to Fergus Falls he had been manager of a public service company in Indiana.

•

Duvall Made Production Manager in Kansas City

Ralph J. Duvall, who had been assistant manager of production and distribution for the Kansas City, Kans., municipal utilities for twelve years, has been appointed manager of production and distribution by the Board of Public Utilities to fill the vacancy created by the death of James D. Donovan. The Board operates the city's water plant, light and power system.

A graduate of the University of Kansas, Mr. Duvall joined the Kansas City, Kansas, utility staff, where he had previously worked during vacation periods

while receiving his technical education. In 1931, he was named electrical engineer for the power station.

Mr. Duvall has been active in various public affairs. He is vice-chairman of the City Planning Commission, a member of the Fairfax Industrial Association and a member of the Chamber of Commerce.

Shawinigan Utility Names W. R. Way Superintendent

W. R. Way, formerly assistant general superintendent of the operating department of the Shawinigan Water & Power Co., Montreal, has been promoted to the position of general superintendent, filling the vacancy caused by the retirement of C. R. Reid.

Arthur S. Gall, formerly superintendent of distributing stations, has been appointed assistant general superintendent of the operating department.

A graduate of McGill University, Mr. Way joined the Shawinigan company in 1918 as assistant engineer, operating

W. R. Way

department, where he successively worked in various divisions of the company, including the protection division, metering division and hydraulic test division. In 1924 he was transferred to Shawinigan Falls in the capacity of chief system operator. Six years later he was transferred to the head office in Montreal in the capacity of assistant superintendent of operation. Subsequently, he was promoted to the position of superintendent of operation, then assistant general superintendent, and finally, in 1944 to general superintendent of the operating department. Mr. Way is a member of the American Institute of Electrical Engineers.

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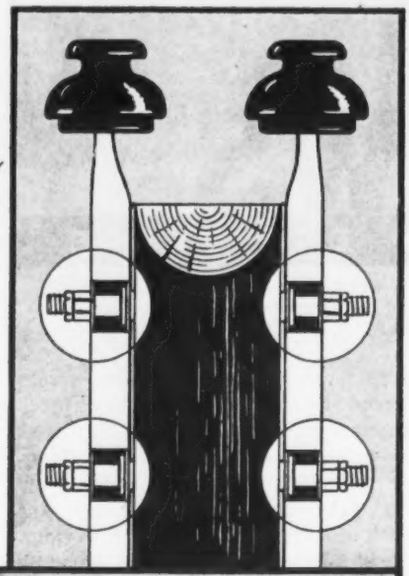
▶George Allard, chairman of the Nevada Public Service Commission, has been named to the National Association of Railroad and Utilities Commissioners' committee for cooperation between state and federal commissions.

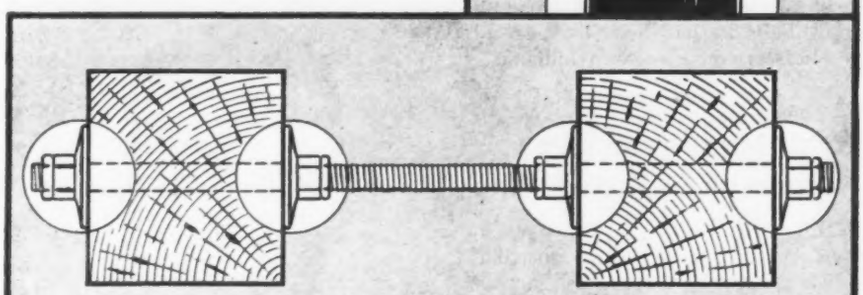
▶George R. Keegan has been appointed director of public relations of the Western Massachusetts Companies with headquarters at Springfield, Mass. He succeeds the late John J. O'Connell

Palnuts

REDUCE RADIO INTERFERENCE

by Keeping Hardware Tight





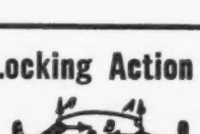
- Top right shows PALNUTS used on Double Pin installation.
- Above is shown Double Arming installation with washer nuts securely locked with PALNUTS.

Tests by power companies show that loose hardware is the main cause of radio interference. And experience proves that the best assurance of tight hardware is to lock all nuts with PALNUTS. This holds the bolt and nut to original tightness and eliminates the need for periodic retightening.

Because PALNUTS apply on top of the regular nut, they are equally adaptable to new and old installations. When retightening present assemblies, have crew add PALNUTS to prevent further loosening.

PALNUTS are single thread, spring tempered steel locknuts, very low in cost and easily tightened with a lineman's wrench. Require only 3 bolt threads space. Powerful double locking spring action* holds tight under vibration or shrinkage of parts.

***Double Locking Action**



When the PALNUT is wrench-tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.

PALNUTS are available in a full range of sizes, materials and finihses for every Utility need. Send for detailed literature on application to power distribution equipment. Samples on request.

THE PALNUT COMPANY
51 Cordier St. Irvington 11, N. J.

Used Today on Aircraft, Tanks, Jeeps, Military Vehicles and other War Equipment

DOUBLE-LOCKING **PALNUTS**

of Pittsfield. Mr. Keegan is a graduate of Boston University and joined the system about 19 years ago. He has worked in the transmission and distribution department, and later became real estate and right-of-way agent.

▶ THOMAS J. SKINKER, acting director of public utilities for the City of St. Louis for the past year and a city employee for more than 25 years, has returned to his former position of water commissioner. Mr. Skinker was named acting director of public utilities on March 1, 1944, to fill the vacancy created when Milton M. Kinsey was promoted to the position of president of the Board of Public Service.

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Rome Cable Corp. Elects Rolston Vice-President

At a meeting of the directors of Rome Cable Corp., Rome, N. Y., Glenn E. Rolston was elected to the board and also made a vice-president of the corporation.

Mr. Rolston has been associated with the company almost since its formation in 1936 as chief sales engineer and brings a wealth of background in the wire and cable industry to his new position. After completing his course at Morningside College, Sioux City, Iowa, in 1923, Mr. Rolston was associated with the United Gas Improvement Co., Philadelphia, Pa., in electric system operating activities. Later he joined the staff of General Cable Corp. as district sales engineer in the Philadelphia area, was transferred to Rome, N. Y., in 1930 as cable design engineer for the Rome plant. In 1934 he was assigned to the New York office of the company in the engineering department. Later he was made merchandise manager for the corporation. Late in 1936 Mr. Rolston joined the staff of Rome Cable Corp. as chief engineer. He is a member of the American Institute of Electrical En-

COMMUNICATION—WITHOUT-WIRES—the keynote of the nation's ability to wage modern war—has brought in its train a great paradox: A need for *more and different cables.* And the same needs will extend into the post-war world.

In the solution of the current problems that this need has raised, we at Ansonia, in all modesty, have played no small part. Ankoseal polyvinyl and polyethylene cables have been designed to meet the particular needs of our Army and Navy — needs which, of course, must remain secret, but which involve using *engineering techniques* in the solution of the problems they present.

To other government agencies requiring "fussy" cable jobs, Ansonia offers the "Yankee ingenuity" which has enabled this organization to meet these requirements—accurately and on time. And to business men now and in the post-war world, Ansonia, through its Ankoseal thermoplastic cables, offers the same ability to meet similar problems to their satisfaction.

Why* ANKOSEAL *solves cable problems

Ankoseal, a thermoplastic insulation, can help solve many electrical engineering problems, now and in the future. *Polyvinyl* Ankoseal possesses notable flame-retarding and oil resisting characteristics; is highly resistant to acids, alkalies, sunlight, moisture, and most solvents. Polyethylene Ankoseal is outstanding for its low dielectric loss in high-frequency transmission. Both have many uses, particularly in the radio and audio fields. Ankoseal cables are the result of extensive laboratory research at Ansonia—the same laboratories apply engineering technique in the solution of cable problems of all types.

THE ANSONIA ELECTRICAL COMPANY

Specializing in "Ankoseal" a Thermoplastic Insulation

ANSONIA • CONNECTICUT

A Wholly-Owned Subsidiary of

NOMA ELECTRIC CORPORATION

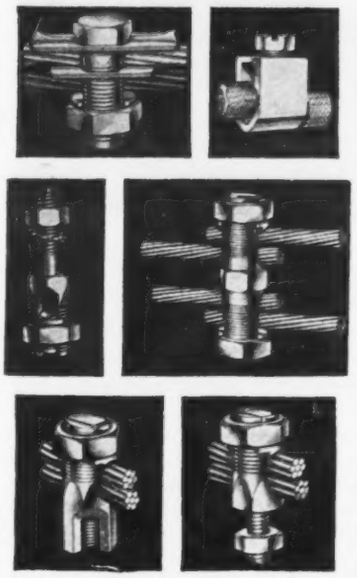
GENERAL OFFICES • NEW YORK, N. Y.

—In peacetime makers of the famous Noma Lights—the greatest name in decorative lighting. Now, manufacturers of fixed mica dielectric capacitors and other radio, radar and electronic equipment.

"All SIZES of SERVICE CONNECTORS—

and All TYPES"

You can find exactly the service connector you need, in the Penn-Union Catalog: Yoke-and-Nut type, in a complete range of sizes . . . Service Entrance connectors . . . Service Post and Special connectors in wide variety.



Also . . . the most complete line of Tee Connectors, Cable Taps . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs . . . practically every good type.

Leading utilities, industrials, electrical manufacturers and contractors have found that "*Penn-Union*" *on a fitting is their best guarantee of Dependability.* Write for the Penn-Union Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

gineers, National Electrical Manufacturers Association, American Society for Testing Materials, American Standards Association and the Technical Advisory Committee War Production Board.

At a meeting of the executive committee held on March 14, the resignation of Charles A. Scott as executive vice-president and director of sales was accepted with regret. Mr. Scott was one of the original group that formed the company in 1936, and had been the head of the sales department since the start.

•

A. Robinson Made Head Electrical Engineer

Allen Robinson has been appointed head electrical engineer of American Steel & Wire Co., and Clare L. Becker has been named assistant electrical engineer with headquarters in Cleveland.

A graduate of Iowa State College, Mr. Robinson has been employed by the American Steel & Wire Co. since 1923.

A. Robinson

when he was hired as an electrical engineer in the Pittsburgh district. In 1927 he was transferred to Donora, Pa., where he held a number of positions in the steel and wire works before being named superintendent of engineering and maintenance in 1944.

Mr. Becker first became identified with the Wire Company in 1930 as works engineer. He has held a number of positions with the company and since 1943 has been section head draftsman.

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▶ A. L. THALHEIMER has retired after 47 years of active service with the Hartford Steam Boiler Inspection & Insurance Co. Mr. Thalheimer was graduated from Sheffield Scientific School, Yale University, in 1889, and conducted an engineering office in Hartford before joining the company. He has been superintendent of the claim department for nine years.

California Edison Makes Operating Assignments

Three promotions in the operating organization of the Southern California Edison Co. have recently been announced by H. W. Tice, vice-president in charge of operation.

W. E. Row, assistant manager of operation for the past three years, was appointed manager of operation. He has been associated with the company's operations for 27 years and has held a number of positions of responsibility, including distribution engineer, electrical engineer, assistant superintendent of distribution, and superintendent of distribution.

W. L. Chadwick advanced from chief civil engineer to manager of the engineering department. A veteran of 18 years with the company, his experience has been varied in engineering phases of utility operation.

W. N. Johnson, formerly superintendent of distribution, was appointed assistant manager of operation. He has served as manager of the company's Vernon City district and has been superintendent of distribution for the past four years. He was chief engineer of the City of Vernon from 1931 to 1937.

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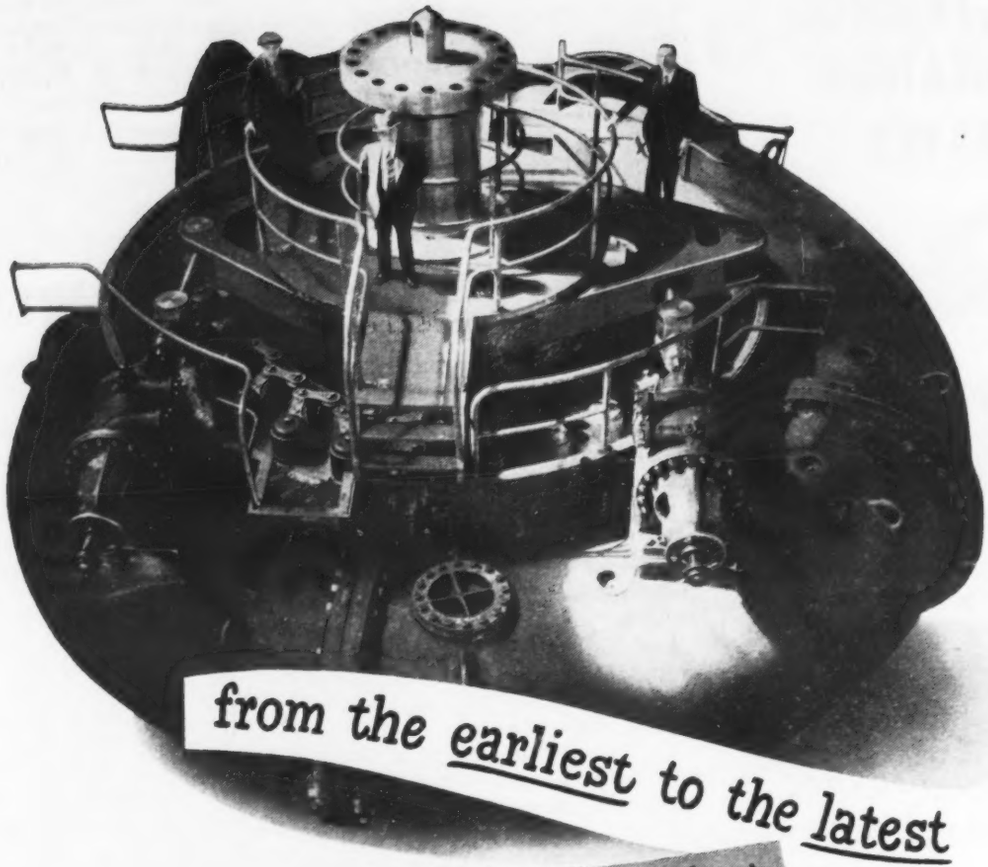
▶ ARTHUR B. SPRAGUE, superintendent of the meter department of the Worcester County Electric Co., Worcester, Mass., and connected with that utility and the predecessor Worcester Electric Light Co., for 44 years, retired as of March 1. His successor is ROBERT A. HEMENWAY, previously foreman of the department. Headquarters will be at 35 Harvard Street, Worcester.

▶ H. F. BERRY, president and general manager of the National Light & Power Co., Moose Jaw, Saskatchewan, has been appointed chairman of the Saskatchewan Power Commission. Mr. Berry succeeds L. A. THORTON, who has just retired, having headed the commission since its organization in 1928.

▶ H. C. HASBROUCK has been appointed to the newly created position of accounting director of the Edison Electric Institute. His principal work will be in the coordination of activities of the several accounting committees of the Institute, and as consultant on accounting and regulatory matters. A graduate of Cornell University, Mr. Hasbrouck became identified with the staff of the New York Public Service Commission for the Second District in its division of statistics and accounts, later becoming deputy chief accountant, in charge of the accounting and statistical



from the earliest to the latest

from the Largest to the smallest

THE EARLIEST—Niagara Falls Power Company, 1895.
THE LATEST—T.V.A., Boulder Dam, and many others.
THE LARGEST—115,000 horsepower.
THE SMALLEST—2/100 horsepower.
TYPES BUILT: Francis (Reaction). Pelton (Impulse).
Kaplan (Adjustable blade). Propeller (Fixed blade).
HIGHEST HEADS IN THE WESTERN HEMISPHERE:
Francis Type; 1,028 feet, Ixtapantongo, Mexico (I. P. Morris)
Pelton Type; 2,562 feet, Pacific Gas & Electric Co.

THE BALDWIN LOCOMOTIVE WORKS, PHILADELPHIA, PENNA.
MANUFACTURING PLANTS: I. P. Morris Department, Eddystone, Pa.
The Pelton Water Wheel Co., San Francisco, Calif.

BLW THE BALDWIN GROUP **BALDWIN**

HYDRAULIC TURBINES

HOLTZER-CABOT ELECTRONIC INSULATION TESTER

Can Help Prevent Production Delays, Shut-Downs and Costly Repairs

By spotting faulty insulation before it breaks down, the Holtzer-Cabot Insulation Resistance Tester enables you to plan and make repairs before they become costly. Light in weight, portable and easy to use, this unit is ready to use anywhere by engineers or maintenance men.

CHECK THESE ADVANTAGES

√ *Hand Generator* eliminates batteries . . . delivers 500 volts D.C. testing voltage.

√ *Electronic Voltage Regulation* assures uniform testing voltage.

√ *Two Indicator Buttons* light up when generator delivers correct testing voltage assuring accurate readings.

√ *Guard Circuit* eliminates surface leakage from affecting measurements.

√ *Light Weight* . . . only three pounds. Makes it ideal for field work.

Range 0 to 100 megohms.

Write for bulletin. It gives the complete story.

HOLTZER-CABOT
Division of First Industrial Corp.
400 STUART STREET, BOSTON 17, MASS.

work of the Albany office of the commission. His work from 1921 to 1942 was chiefly that of a consulting accountant for the central management of the Associated Gas & Electric System, and he also served at various times as an officer or director of a number of System companies. Mr. Hasbrouck has been active for a number of years in association work, with the old National Electric Light Association and its successor, the Edison Electric Institute, and also with the American Gas Association.

•

Interstate Power Makes Engineering Assignments

Several recent promotions and changes of personnel have been announced by the Interstate Power Co., Dubuque, Iowa.

J. A. VanDenBerg of the company's Alber Lea (Minn.) district has been transferred to the general offices in Dubuque, in charge of the land and tax division.

L. P. Harlan has been assigned charge of the company's production division, succeeding Paul T. Woodnorth who has entered industrial work in Chicago.

Cyril Blasing of Albert Lea (Minn.) has been promoted to power plant chief engineer at Dubuque.

E. M. Lindsey, a new member of the organization, has been placed in charge of construction.

E. P. Nancy formerly transmission and distribution engineer has been named assistant chief engineer. Harry Chambers, relay engineer is now in charge of transmission.

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► DR. CHARLES MCKINLEY of Reed College, Portland, Ore., has replaced BEN F. KIZER of Spokane, Wash., as chairman of the Bonneville Regional Advisory Council, and HENRY ALDERMAN of Portland has succeeded COL. ROY E. BESSEY, Portland, as executive secretary of the council. Both Mr. Kizer and Col. Bessey have accepted positions with the United Nations Relief & Rehabilitation Committee for service in China. Mayor Herbert West of Walla Walla, Wash., remains as vice-chairman of the council.

► J. WALTER DIETZ, industrial relations manager of the Western Electric Co.'s manufacturing department, has retired under the company's pension plan after more than 42 years of service. On leave of absence for the past four years, Mr. Dietz has been a top executive in the Government's industrial training program, which is now a part of the War Manpower Commission in Washington, D. C.

Taylor-Colquitt Elects Brown Vice-President

Announcement has been made by the Taylor-Colquitt Co., Spartanburg, S. C., of the election of M. P. Brown, sales manager, to the position of vice-president in charge of sales.

Mr. Brown has spent the major part of his business life with the Taylor-Colquitt organization. He joined the staff in 1926 in the capacity of payroll clerk and subsequently became foreman of the pole yard. During the intercening years Mr. Brown has filled almost every position in the sales department.

•

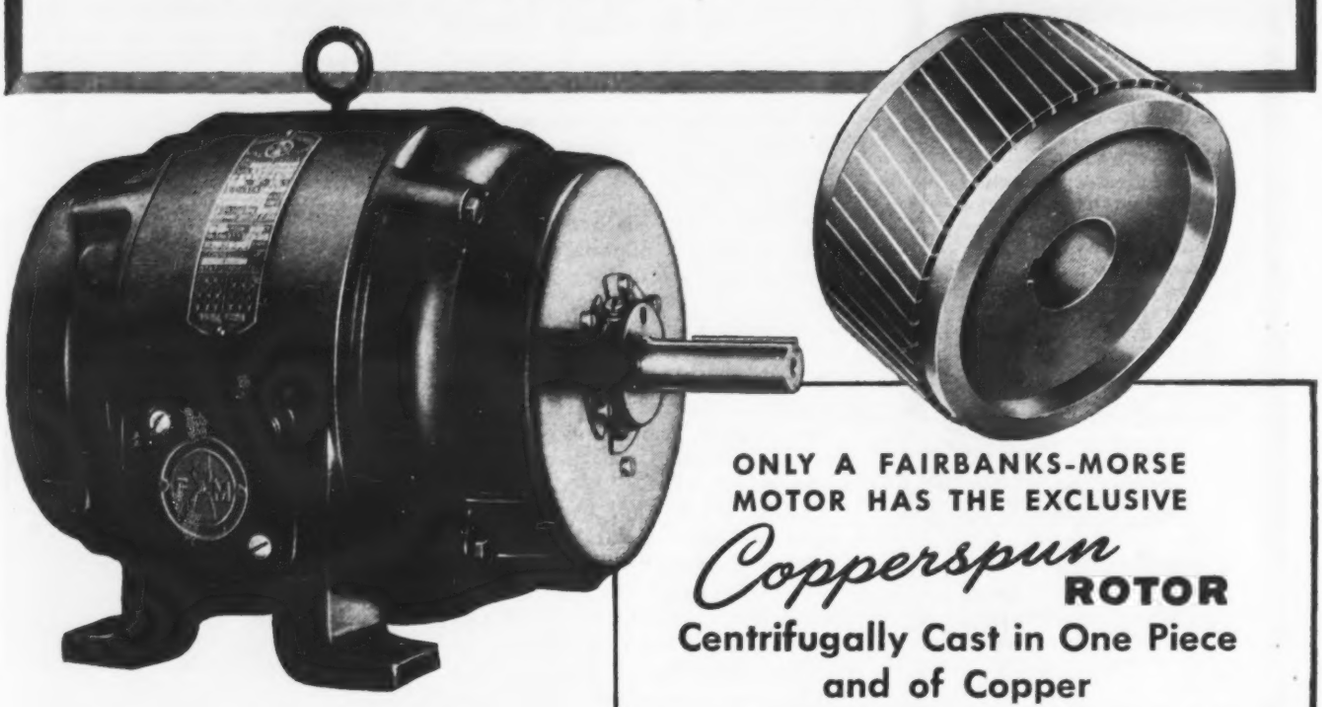
► H. G. BARNES has been appointed vice-president of the National Battery Co. and its Gould commercial division, succeeding Herbert King. His headquarters will be in St. Paul, Minn. Mr. Barnes has been associated with the National Battery Co. since 1940, when he was appointed vice-president and general manager of National's Gould commercial division with headquarters at Depew, N. Y. RICHARD H. ROWLAND has been elected vice-president of the company in charge of its Gould industrial division (Gould Storage Battery Corp.), Depew, to succeed Mr. Barnes. Prior to his new connection, Mr. Rowland was vice-president of the Saint Paul Engineering & Manufacturing Co.

► JAY J. GOODMAN, associated with the commercial department of the Northwestern Electric Co., Portland, Ore., for the past 21 years, has resigned to become assistant sales manager of Gilbert's Brothers, Inc., wholesalers of electrical and hardware supplies. Mr. Goodman is a long time member of the Electric Club of Portland, and served as its president in 1944. He is also a member of the Northwest Electric Light and Power Association, and the Portland Home Builders Association.

► JULES THORN, one of the best known figures in the radio field in England and on the Continent, arrived in New York recently for a 60-day visit. Managing Director of the Thorn Electrical Industries, fluorescent lamp manufacturer in England, and the Ferguson Radio Co., Mr. Thorn has worked extensively with American manufacturers.

► DR. ZAY JEFFRIES, vice-president of General Electric Co., with headquarters in Pittsfield, Mass., was recently awarded the newly established annual powder metallurgy medal of the Stevens Institute of Technology, when he delivered the annual lecture sponsored by the Powder Metallurgy Laboratory of

A BETTER ROTOR
A BETTER MOTOR



ONLY A FAIRBANKS-MORSE MOTOR HAS THE EXCLUSIVE

Copperspun **ROTOR**

Centrifugally Cast in One Piece and of Copper

It took *years* to develop the Fairbanks-Morse centrifugally-cast, one-piece copper rotor. But it's worth it. Reduced operating costs and longer, more dependable service are the results.

But those aren't the only advantages you get in a Fairbanks-Morse Motor. There's a long list of other features that all add up to *better* service for you. Note the list below. That's why we call it tomorrow's motor today.

Check List of Plus Features

Protected Frame— Dripping liquids and falling particles excluded in any mounting position.

Symmetrical Design— Reversible frame provides for locating conduit box on either side. Bearing arms can be mounted in any one of four positions 90° apart.

Crossflow Ventilation—Another exclusive feature in frames 224 to 365 inclusive. Air moves in both directions, providing a motor of uniform temperature. No hot spots.

Recessed Conduit Box—An innovation for neat installations. Choice of conventional box or frame recess with cover flush with frame.

Balanced Characteristics— Motor rated 40°C with high efficiency and power factor and excellent starting and accelerating torques.

Ball Bearings— Sealed in and protected.

Write for information, Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

BUY MORE WAR BONDS

Fairbanks-Morse

A name worth remembering

Diesel Locomotives · Diesel Engines · Generators · Motors · Pumps · Scales
Magnetos · Stokers · Railroad Motor Cars and Standpipes · Farm Equipment

HOLTZER-CABOT ELECTRONIC INSULATION TESTER

Can Help Prevent Production Delays, Shut-Downs and Costly Repairs

By spotting faulty insulation before it breaks down, the Holtzer-Cabot Insulation Resistance Tester enables you to plan and make repairs before they become costly. Light in weight, portable and easy to use, this unit is ready to use anywhere by engineers or maintenance men.

CHECK THESE ADVANTAGES

✓ *Hand Generator* eliminates batteries . . . delivers 500 volts D.C. testing voltage.

✓ *Electronic Voltage Regulation* assures uniform testing voltage.

✓ *Two Indicator Buttons* light up when generator delivers correct testing voltage assuring accurate readings.

✓ *Guard Circuit* eliminates surface leakage from affecting measurements.

✓ *Light Weight* . . . only three pounds. Makes it ideal for field work.

Range 0 to 100 megohms.

Write for bulletin. It gives the complete story.

HOLTZER-CABOT
Division of First Industrial Corp.
400 STUART STREET, BOSTON 17, MASS.

work of the Albany office of the commission. His work from 1921 to 1942 was chiefly that of a consulting accountant for the central management of the Associated Gas & Electric System, and he also served at various times as an officer or director of a number of System companies. Mr. Hasbrouck has been active for a number of years in association work, with the old National Electric Light Association and its successor, the Edison Electric Institute, and also with the American Gas Association.

•

Interstate Power Makes Engineering Assignments

Several recent promotions and changes of personnel have been announced by the Interstate Power Co., Dubuque, Iowa.

J. A. VanDenBerg of the company's Alber Lea (Minn.) district has been transferred to the general offices in Dubuque, in charge of the land and tax division.

L. P. Harlan has been assigned charge of the company's production division, succeeding Paul T. Woodnorth who has entered industrial work in Chicago.

Cyril Blasing of Albert Lea (Minn.) has been promoted to power plant chief engineer at Dubuque.

E. M. Lindsey, a new member of the organization, has been placed in charge of construction.

E. P. Nancy formerly transmission and distribution engineer has been named assistant chief engineer. Harry Chambers, relay engineer is now in charge of transmission.

•

► DR. CHARLES MCKINLEY of Reed College, Portland, Ore., has replaced BEN F. KIZER of Spokane, Wash., as chairman of the Bonneville Regional Advisory Council, and HENRY ALDERMAN of Portland has succeeded COL. ROY E. BESSEY, Portland, as executive secretary of the council. Both Mr. Kizer and Col. Bessey have accepted positions with the United Nations Relief & Rehabilitation Committee for service in China. Mayor Herbert West of Walla Walla, Wash., remains as vice-chairman of the council.

► J. WALTER DIETZ, industrial relations manager of the Western Electric Co.'s manufacturing department, has retired under the company's pension plan after more than 42 years of service. On leave of absence for the past four years, Mr. Dietz has been a top executive in the Government's industrial training program, which is now a part of the War Manpower Commission in Washington, D. C.

Taylor-Colquitt Elects Brown Vice-President

Announcement has been made by the Taylor-Colquitt Co., Spartanburg, S. C., of the election of M. P. Brown, sales manager, to the position of vice-president in charge of sales.

Mr. Brown has spent the major part of his business life with the Taylor-Colquitt organization. He joined the staff in 1926 in the capacity of payroll clerk and subsequently became foreman of the pole yard. During the intercening years Mr. Brown has filled almost every position in the sales department.

•

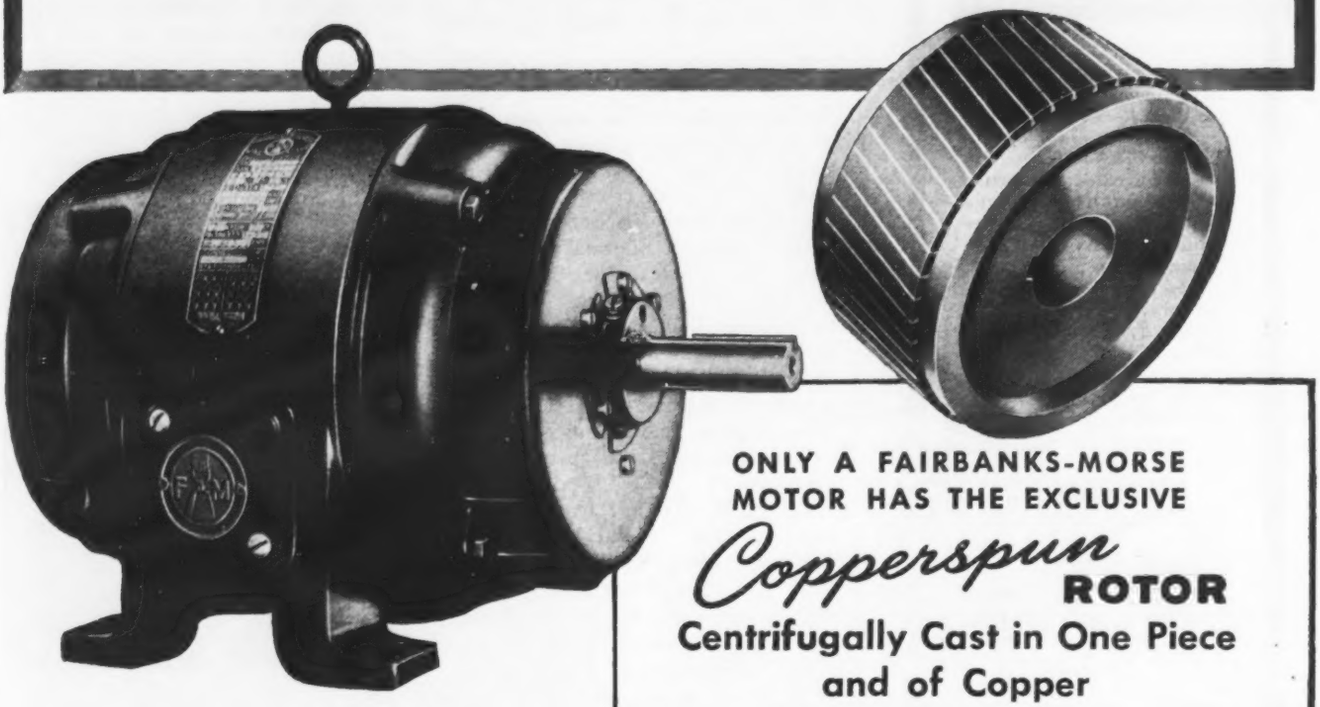
► H. G. BARNES has been appointed vice-president of the National Battery Co. and its Gould commercial division, succeeding Herbert King. His headquarters will be in St. Paul, Minn. Mr. Barnes has been associated with the National Battery Co. since 1940, when he was appointed vice-president and general manager of National's Gould commercial division with headquarters at Depew, N. Y. RICHARD H. ROWLAND has been elected vice-president of the company in charge of its Gould industrial division (Gould Storage Battery Corp.), Depew, to succeed Mr. Barnes. Prior to his new connection, Mr. Rowland was vice-president of the Saint Paul Engineering & Manufacturing Co.

► JAY J. GOODMAN, associated with the commercial department of the Northwestern Electric Co., Portland, Ore., for the past 21 years, has resigned to become assistant sales manager of Gilbert's Brothers, Inc., wholesalers of electrical and hardware supplies. Mr. Goodman is a long time member of the Electric Club of Portland, and served as its president in 1944. He is also a member of the Northwest Electric Light and Power Association, and the Portland Home Builders Association.

► JULES THORN, one of the best known figures in the radio field in England and on the Continent, arrived in New York recently for a 60-day visit. Managing Director of the Thorn Electrical Industries, fluorescent lamp manufacturer in England, and the Ferguson Radio Co., Mr. Thorn has worked extensively with American manufacturers.

► DR. ZAY JEFFRIES, vice-president of General Electric Co., with headquarters in Pittsfield, Mass., was recently awarded the newly established annual powder metallurgy medal of the Stevens Institute of Technology, when he delivered the annual lecture sponsored by the Powder Metallurgy Laboratory of

A BETTER ROTOR
A BETTER MOTOR



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BUY MORE WAR BONDS

Fairbanks-Morse

A name worth remembering

Diesel Locomotives · Diesel Engines · Generators · Motors · Pumps · Scales
Magnetos · Stokers · Railroad Motor Cars and Standpipes · Farm Equipment

NEW, IMPROVED—

40% Greater Discharge Capacity

IDEAL Rechargeable FLASHLIGHT BATTERY

The HUNDREDS OF THOUSANDS in use indicate the fine service these *Rechargeable* Flashlight Batteries are giving. Increased discharge capacity means increased satisfaction —MUCH BRIGHTER, LONGER SUSTAINED LIGHT— slower voltage drop assuring longer TOP-LEVEL LIGHT VOLUME. Can OUTLAST 400 or more DRY CELLS. SAVES up to $10 on each flashlight.

Write for Bulletin BB 444

Fits standard flashlight case using two- 1¼" size D dry cells. GUARANTEED.

★

IDEAL BATTERY CHARGER

Plugs into any light socket. Available in single, 6-gang and 12-gang types. Also rechargeable from automobile ignition line.

PROMPT DELIVERY

IDEAL Sycamore

Storage Battery Division
IDEAL COMMUTATOR DRESSER CO.
1021 Park Ave., Sycamore, Ill.
Sales offices in all principal cities
In Canada: Irving Smith Ltd., Montreal, Quebec

the College. The medal, which was presented for the first time, on behalf of the Trustees by Dr. Harvey N. Davis, President of Stevens, is made entirely from powdered metals, and it is awarded for "outstanding work in the field of powder metallurgy."

•

New Appointments Made by Sylvania Electric

Appointment of Stuart Goodwillie as manager of the central station sales in the lighting division has been announced by Sylvania Electric Products Inc. For the last two and a half years Mr. Goodwillie has been in charge of organization development for Sylvania.

Dr. Bennett S. Ellefson has been appointed assistant to the vice-president in charge of engineering, with offices at Sylvania Center, Bayside, Long Island. Associated with the company since 1937, Dr. Ellefson has specialized in research on fluorescent screens, special uses of glass, fluorescent powders for cathode ray tubes and specialized war products.

Elliott W. Hazzard has been made sales manager of the European and African section of the International division. Mr. Hazzard has been in the export-import business for eight years, and has lived abroad for 21 years.

The appointment of Walter R. Jones to the newly created position of general engineering manager for radio receiving tubes has also been announced. Formerly manager of commercial engineering, Mr. Jones joined Sylvania in 1929.

Robert Beatty, formerly chief of Division C, War Production Board, has been appointed sales manager of the tungsten and the weld and wire products of the Warren and Towanda, Pa., plants. Prior to his affiliation with WPB, Mr. Beatty was sales engineer with the Driver-Harris Co. and the Aluminum Co. of America. He will make his headquarters at the Warren, Pa., plant.

•

▶ PHILIP D. REED, chairman of the board of the General Electric Co. and the International General Electric Co., has been named chairman of the American Section of the International Chamber of Commerce, succeeding Eliot Wadsworth of Boston, resigned.

▶ CHARLES EISLER, owner and director of the Eisler Engineering Co., Newark, N. J., has been elected president of the Resistance Welder Manufacturers' Association. Mr. Eisler has been in the resistance welding field for a quarter of a century. Since the reorganization of R.W.M.A. in 1938, he has been active in its affairs.

OBITUARY

William L. Enfield

William L. Enfield, widely known electrical engineer and a pioneer in the development of lamps and lighting, died suddenly on March 21 in Cleveland as the result of a heart attack. At the time of his death, Mr. Enfield held the position of consulting engineer for General Electric lamp department with which he had been associated for more than 35 years.

For 25 years, from 1914 to 1939, he held the position of manager of the G.E. Lamp Development Laboratory at Nela Park. Although he resigned this

position in 1939, Mr. Enfield played a leading role in the development at Nela Park of scores of new lamps and other devices for the armed forces since Pearl Harbor.

Much of the progress which took place in the development of light sources and in the modern art of lamp manufacture during the quarter century he headed the lamp development laboratory at Nela may be attributed to Mr. Enfield.

Born at Chase, Kans., in 1879, Mr. Enfield attended Kansas State College, the University of Chicago, Massachusetts Institute of Technology and held degrees of Bachelor of Science in electrical engineering and Doctor of Engineering at Kansas State College. He was a fellow of the American Institute of Electrical Engineers and held membership in numerous scientific and technical societies.

•

▶ COLIN F. CHISHOLM, 84, former vice-president of the Suburban Gas & Electric Co., Revere, Mass., died in that city on March 17. He was born in Heatherton, N. S., and joined the company in 1885. From 1914 to 1936 Mr. Chisholm was its local manager, becoming vice-president in the latter year.

WHAT WEAPON are they all using?

It's an old friend of yours – and it is used by every branch of the Armed Services!

ANTI-AIRCRAFT ARTILLERY fire is coordinated and controlled by field telephone—the brother of your familiar Bell System telephone.

ON OUR SUBMARINES, sound powered telephones, operating on current generated by the speaker's voice, connect all battle stations.

THE ARMORED FORCES use radio telephone to inter-connect tanks, scout cars, command cars, artillery units and anti-tank vehicles.

ON BATTLESHIPS, Aircraft Carriers, Cruisers, Destroyers, battle announcing systems give orders in a giant voice over loudspeaking telephones.

THE MARINE CORPS, storming ashore into almost impassable jungles, depends upon field telephones to deliver orders and reports instantly.

THIS COAST GUARDSMAN, standing watch, telephones warnings to the bridge to help keep the convoy's many ships in protected formation.

ARMY AIR FORCES planes by the hundreds fly and fight as one team because of their radio telephone — and interphone equipment.

THE SIGNAL CORPS provides the circuits for Victory—thousands upon thousands of miles of telephone wires needed to coordinate the attack.

THE INFANTRY uses great quantities of portable switchboards, field telephones and wire to link foxholes, command posts and headquarters.

FIELD ARTILLERY "Long Toms," blasting unseen targets, are directed by voices flashing through multi-channel radio telephone sets.

YOU best know your telephone as a friendly instrument of peace. Our fighting men know it as an effective weapon of war.

Western Electric has put in the hands of the armed forces huge quantities of telephones, switchboards, wire, cable—specialized radio telephone equipment for use on land, at sea, in the air—many types of microphones and headsets by the hundreds of thousands—sound powered telephones—battle announcing systems. Currently all these products together add up to only 40% of Western Electric's total production for war. The other 60% includes such specialized devices as RADAR.

Manpower and manufacturing facilities are devoted to meeting our fighters' vast needs. That's why not all requests for home telephones can be filled till after Victory.

Buy all the War Bonds you can—and keep them!

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

MANUFACTURING MARKETS

Northwest Industries Plan to Retain Gains

13 Washington Manufacturers Form Pool and Set Up Seattle Headquarters to Get Business

Conclusive evidence that industry in the Pacific Northwest, is laying ground plans for occupying a place of lasting importance in the nation's post-war economic framework was seen in the formation in Seattle, Wash., in Mid-March of a potentially formidable alliance of leading industrial groups.

The pool, to be known as Production Associates, was comprised of 13 "charter" industrial plants, and indications were that the combined managements contemplate invading every economic and manufacturing field open to them through the production of electrical, plastic, machinery, steel, brass, aluminum and other type products.

Symptoms that the Seattle pool is to be merely the nucleus of a much larger and more powerful organization encompassing virtually the entire Pacific Northwest were seen in the avid interest evidenced in its formation by executives and leaders of other industries as far south as Portland and east to Spokane.

Formed to Retain Business

The alliance is under the presidency and leadershhip of Mark R. Colby, president of Colby Steel & Engineering Co., of Seattle, and has for its announced aim the "institution of a united drive for business in competition with powerful, well equipped rivals in other sections of the nation, in an effort to maintain and even expand present war-time peaks of activity."

Mr. Colby said that members of the pool are convinced the time is appropriate for them to take the initiative in securing national distribution of products of Pacific Northwest industrial plants, and that they intend to accomplish that purpose through their Seattle headquarters.

Wayne Haines, head of a Seattle machine works bearing his name, will have charge of the office as manager-director, and J. S. Criswell with offices in San Francisco, New York and Washington, D. C., will serve as national sales representative.

R. S. Hollister, vice-president of Ketchum Wire & Manufacturing Co., is vice-president of the association, and C. B. MacDougall, president of Nemco Electric Co., is treasurer. Other firm members of the pool include Seattle Lighting Fixture Co., Eagle Brass Foundry Co., Morel Foundry, Ballard Plastics Corp., and Prescott Iron Works, all of Seattle; George R, Marvin Co., Washington Steel & Welding Co., and Heatlox Furnaces, all of Tacoma, and Skagit Steel & Iron Works of Sedro Woolley.

Mr. Colby explained that the industrial pool plans to canvass the national field for large orders that can be parceled out among its members in accordance with their respective facilities, and delivered to customers as completed units of machinery, equipment and other items of production, in much the same manner as is now used in war production, through the subletting of contracts.

150 DIFFERENT COMBINATIONS — Necessity for having individually designed industrial resistance welding controls is eliminated by eleven standard basic units which can be used in 150 combinations. T. R. Lawson, resistance welding application manager, Westinghouse Electric & Manufacturing Co., demonstrates with models

Allis-Chalmers Sales Hit All-Time High

Allis-Chalmers Manufacturing Co. in 1944 produced more than three times as much as it did the year of the attack on Pearl Harbor and its billings reached on all-time high, according to the annual report just issued stockholders. The report, however, showed considerable slackening in the backlog of orders and in bookings due to shifts in war production requirements.

Sales billed for 1944 totaled $379,495,631 and its earnings were $9,327,616. After preferred stock dividend requirements, the profits per share of common stock amounted to $4.77. This compares with 1943 sales of $295,996,435 and with a profit of $8,006,369, equivalent to $4.51 a common share.

The order backlog, due to completion of some war contracts and shifts in other war demands, dropped $126,000,000, but a substantial backlog still remains. As of December 31, 1944, the backlog stood at $209,680,268 in comparison with the record $335,926,644 the preceding year. Bookings for 1944 were $253,239,255 in comparison with the 1943 all-time peak of $461,490,230.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, has appointed Robert J. Overstreet as representative in North and South Carolina and eastern Georgia.

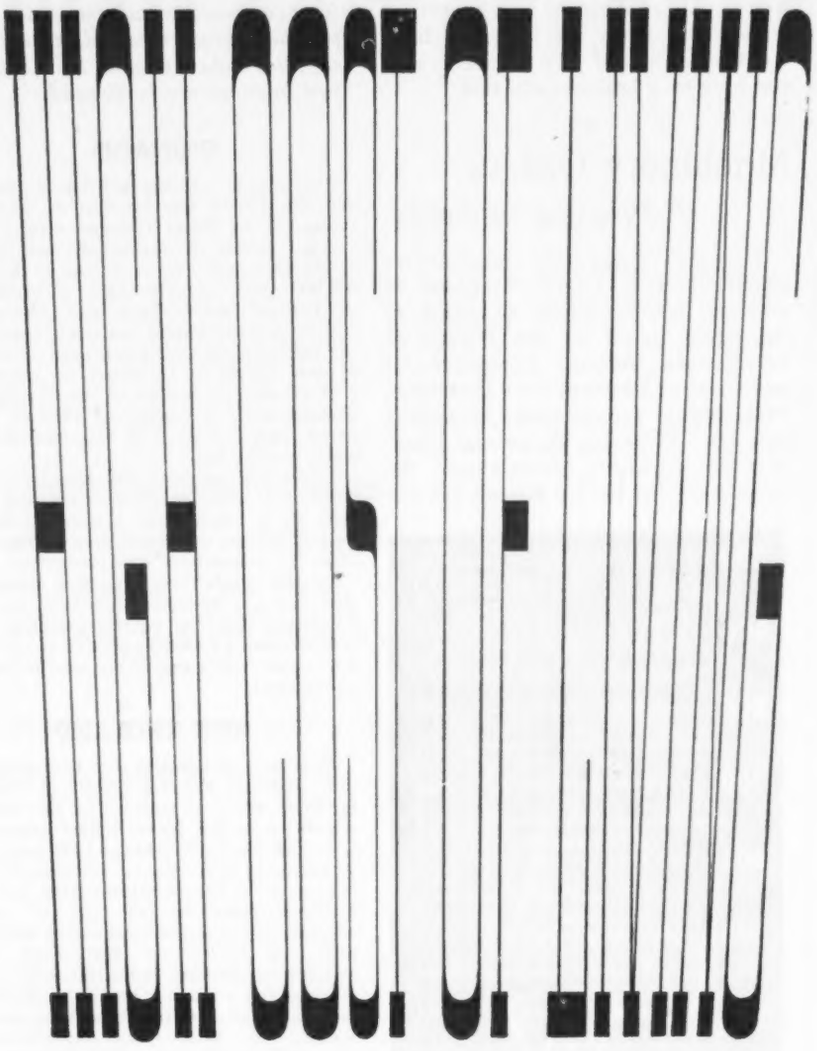
PROCTOR ELECTRIC CO., Philadelphia, has named Edward J. Eckert district manager of the Pittsburgh area. Mr. Eckert will make his headquarters in Pittsburgh and his territory will cover western Pennsylvania, eastern Ohio and West Virginia. Announcement has also been made of the re-appointment of Tom Kenna as Philadelphia district manager. His territory will cover eastern Pennsylvania, western Jersey and Wilmington, Del. Before the war, Mr. Kenna represented Proctor in the Philadelphia district, but for the past two and one-half years he has been the OPA fuel rationing officer in Pennsylvania.

•

Sees Post-War Appliance Market in Brazil

Manufacturers of electrical appliances in the United States will find a most receptive market in Brazil after the war, reported Edmond R. Duford, engineer of Sao Paulo Tramway, Light & Power Co., who left Miami recently for Rio de Janeiro on the South America Clipper

IT'S ALL IN THE WAY YOU LOOK AT IT!



(The lines at the right may look like a mystic maze. But if you close one eye and tilt this page to the position shown, you can easily read four familiar words.)

MAYBE you won't thank us for reminding you of the H C of L. But *it doesn't seem nearly so high when you look at it in the light of your electric bill!*

Almost alone among household necessities, the price of electricity has not spiraled upward with war. Official government figures* show that the average price of electricity has *dropped* 3.2% since 1939!

That's especially good news now, but it continues a long-time trend. Electric prices have been coming down so steadily that *the average American family gets about twice as much electricity for its money today as it did 15 years ago.*

If your bill is no smaller, it's because you're using more electricity to do more jobs than you did then. But the saving is *there.*

It has been accomplished by America's light and power companies in spite of rising costs and taxes — on top of tremendous war demands for electric service that were met without delay, shortage or rationing.

It was done by efficiency and experience and sound *business* management — by the same American enterprise which built our nation and on which its future depends.

• *Hear* NELSON EDDY *in* "THE ELECTRIC HOUR," *with Robert Armbruster's Orchestra. Every Sunday afternoon, 4:30, EWT, CBS.*

167 ELECTRIC LIGHT AND POWER COMPANIES*

SELF-SUPPORTING, TAX-PAYING BUSINESSES

** Names on request from this magazine.*

*Bureau of Labor Statistics.

DON'T WASTE ELECTRICITY JUST BECAUSE IT'S CHEAP AND ISN'T RATIONED!

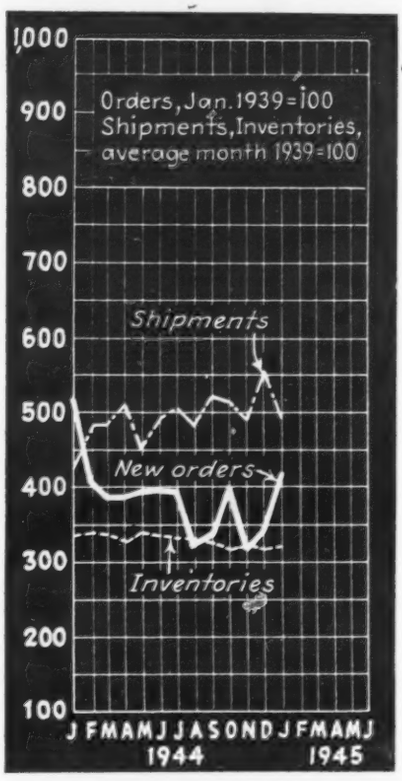
of Pan American World Airways.

"Orders are already being booked for all electrical appliances for post-war delivery. All appliances, such as refrigerators and stoves are imported from the United States," the engineer who was here on a business trip said.

•

Machinery Orders Advance Sharply

The value of new orders placed with manufacturers in January exceeded all previous monthly totals, according to the report issued by the Bureau of Foreign and Domestic Commerce. It was a rise of 8 percent from December, 1944, and 25 percent above January a year ago. Following the general trend, electrical machinery orders soared, the index compiled by the Bureau advanc-



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

ing to 423 from 344 (revised) in December, though January was not a record for this group of manufacturers, the index reaching 523 in January, 1944.

Electrical machinery inventories index moved slightly upward in January to 322.4 from 318.2 (revised) in December, 1944. It stood at 339.5 in January, 1944.

The index of electrical machinery shipments dropped to 490 in January, 1945, from 556 in December, 1944 and comparing with 429 in January, 1944.

Field Reports on Business

New construction and conversion of existing facilities at various naval stations scheduled in the new budget for 1946 will involve sizeable amounts of electrical supplies and equipment. Distribution line equipment, small motors and machine tool bearings are in demand.

CHICAGO

Acceleration of war activity in Europe and the Pacific has brought to manufacturers in the Great Chicago area a substantial volume of war supply and facility contracts reportedly in excess of $4,000,000,000 since January, 1945, according to the Federal Reserve Bank here. Manpower and to a lesser extent materials constitute the principal factors which limit execution of new contracts. Currently an estimated ¾ of all war production in the Chicago industrial area is considered critical, compared with one third in this classification eight months ago.

Labor and material shortages have been worsening. Factory employment and payrolls show virtually no seasonal drop off, indicating that this usual drop off has been offset by stepped up war production.

In the utility industry, too, manpower shortages and material restrictions are still limiting activity to strictly essential projects, necessary to keep capacity at adequate levels and system availability and reliability unimpaired.

NEW ENGLAND

Specific expenditures for new construction and for the conversion of existing facilities at naval stations in this district scheduled in the Navy Budget announced last week for the fiscal year 1946 made very agreeable news for the electrical trade. Not only were the appropriations large, but they involved plans for the use of sizable amounts of electrical equipment and supplies. At Portsmouth Navy Yard, plans call for overhauling industrial utilities, replacing and removing buildings, $300,000; installation of mechanical handling systems, tracks, etc., $1,600,000; construction of electrical distribution plant, $450,000, and conversion of yard facilities to increase output, $700,000. At the Boston Navy Yard among outstanding items of expenditures are installation of new cranes, $600,000; yard facilities conversion to meet new output requirements, $1,000,000; and building construction, $110,000. New communication systems for both these yards are asked at a cost of $90,000 and new elevator installations are required that will cost $125,000.

Rhode Island naval stations are listed in the new Naval Budget where notable expenditures have been recommended. These include $350,000 for heavy cranes; $50,000 for new communication systems; and $55,000 for fire protection.

Cabot Carbon Co., Boston, Mass., has received a DFC contract allocation of $1,500,000 for a middle west plant. Scovill Mfg. Co., Waterbury, Conn., has been alloted $500,000 for improvements and new equipment by the same agency and Plymouth Rubber Co., Canton, Mass., has been authorized $90,000 for new machinery. Aeronautical Radio Inc., Washington, D. C., has leased space at Deer Island, Boston, where it is proposed to install transmission and receiving equipment to serve airline companies in this area.

Navy contracts received last week include distribution line equipment, The National Co., Malden, Mass.; General Electric motor parts, $47,405; electrocardigraphs, Cambridge (Mass.) Instrument Company, Cambridge, Mass., and numerous large machine tool bearing orders in Connecticut, among which was one for over $33,000 for New Departure Div. General Motors, Bristol. U. S. Treasury Surplus Property Division, Boston, reports increasing interest among jobbers and distributors.

PACIFIC COAST

Stock conditions in this area are in less favorable shape than during last fall especially in such key items as staple sizes of rubber-covered wire and rigid iron conduit. Type R building wire has been practically superseded by the SN synthetic style, and the latter is scarce though, inconsistently, steadily decreasing in price, the reduction for average stock quantities and sizes being about 30 percent since December. The smaller conduit fitting situation has improved very little. The wire shortage is ascribed largely to factory replacement of signal wire dumps destroyed in the German theatre of operations. Building construction is spearheaded by new housing, mainly for naval personnel and their families.

Industrial developments include expansion of Shell Chemical's plant at Torrance, Calif., a projected $3,000,000 plywood factory at Corning in the Central Valley; a $600,000 addition to Weyerhauser Timber Co.'s bleach plant at Everett, Wash.; a $400,000 power plant for Northern Pacific at Laurel, Mont.; and a $664,228 low bid for additions to Boeing's Renton factory.

Typical machinery orders cover a 44-ton diesel electric locomotive, costing $44,000 for a lumber company; 400 one to three horsepower motors for pressure pump outfits; and considerable assortments of medium distribution transformers for utility central stocks.

Electrical wholesalers report many applications from women lately employed in industrial establishments.

NEW YORK

Military requirements continue to tax productive capacities, preventing resumption of output for civilian use in any substantial quantities. To achieve the $65,000,000,000 total of war production that will be required this year, there must be an increase of 10 percent in aggregate output, according to the War Production Board.

Civil engineering construction volume in continental United States totaled $23,559,000 last week, according to *Engineering News-Record*. This volume, was 42 percent lower than in the preceding week and 28 percent under the total for the corresponding 1944 week. Private construction was down 49 percent compared with a week ago, but was 65 percent higher than in the corresponding week last year. The week's volume brought 1945 construction to $342,906,000 for the twelve weeks, a decrease of 19 percent from the $420,710,000 reported for the similar period in 1944.

Retail trade moved to its pre-Easter shopping peak last week, volume being extremely heavy in apparel, accessories and seasonal items. Estimates indicated dollar value of department stores ran 25 percent or more over the similar week of last year.

Gates — Intake, Sluiceway and Spillway

Hydraulic Turbines — Francis and Propeller Types

Rack Rakes • Trash Racks

Valves — Pipe Line and Penstock

★

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

NEWPORT NEWS, VIRGINIA

Just Published

these 3 McGRAW-HILL BOOKS

See one or all 10 days on approval!

ELECTRICAL ESSENTIALS IN MARINE SERVICE

Volume I, Marine Electricians' Library

By J. M. Dodds, Field Engineer, Pacific Engineering Division, General Electric Company.

In readable, easy-to-understand language, it explains the essential principles of electricity and magnetism and the characteristics of electrical circuits. Both alternating and direct current are discussed and their various uses described and compared. The book also includes a review of mathematics, physics, and mechanics of use to the marine electrician. This volume, complete in itself, is the first of three books giving a thorough reference handbook treatment of all phases of marine electricity.

415 pages, $3.00

ELECTRICAL DRAFTING

By D. Walter Van Gieson, Assistant Electrical Engineer, Board of Transportation, City of New York.

This book gives you tested drafting techniques needed in engineering and contracting as applied to electrical circuits and wiring plans. In a progressive series of drawing plates and explanatory discussions, the book shows how to develop detailed wiring plans from the schematic circuit diagram, how to correlate the equipment-location plan, and how to check the design and execution of the finished drawing.

140 pages, $1.50

HIGH-FREQUENCY INDUCTION HEATING

By Frank W. Curtis, Consulting Engineer, Springfield, Mass.

Here is your answer to production problems in metal working—a technique of applying high-frequency current to give rapid, localized, intensive heat . . . quickly, easily . . . and *economically*. Now all the material you need on theory, practice, and application has been gathered together in one conenvient and comprehensive book—ideal both as an introduction to the possibilities of induction heating, and as a ready reference handbook of design and procedure.

235 pages, $2.75

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Send me the books checked below for 10 days examination on approval. In 10 days I will pay for books plus few cents postage or return them postpaid. (Postage paid on cash orders.)

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☐ Curtis—High-frequency Induction Heating, $2.75

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Books sent on approval in the United States only.)

Sales Opportunities

IOWA—Iowa Public Service Co., Sioux City, has approved plans for new transmission line and work will be placed in progress at once. This is part of a line extension program to cost about $165,000. Project is understood to have a priority rating.

WASHINGTON—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans new electric, radio and radar shop at Navy Yard, consisting of large one-story building, to cost $3,400,000, with electrical and other equipment. Also will build a new battery and fire control shop, estimated at $2,400,000, and will convert an existing building, No. 427, for a machine shop, at cost of $150,000. A new salvage shop is planned to cost approximately $425,000. Appropriations have been authorized.

TENNESSEE—Mohawk Rubber Co., 1235 2nd Ave., Akron, Ohio, has contracted with government for construction and operation of new plant to be used for manufacture of heavy-duty tires for military trucks and vehicles, and will comprise a main one-story structure, 160 by 650 ft., and several smaller buildings, with electrical and other equipment for large capacity. Power supply will be secured from local municipal system, with power substation to be located on plant site for distribution service. A boiler plant will be built for furnishing steam required for processing operations. Entire project will cost about $2,500,000, with financing by Defense Plant Corporation. Work is scheduled to begin at early date.

PENNSYLVANIA — Philadelphia Electric Co., Philadelphia, will build new stacks at Southwark Station, requiring about 250 tons of structural steel and will soon award contract for work.

DISTRICT OF COLUMBIA—Bureau of Ordnance, Navy Department, Washington, plans extensions and improvements in power plant at local navy yard, estimated to cost about $900,000, of which $300,000 will be expended in electrical division and $600,000 in steam-generating department. Also will make additions and improvements in street-lighting system at yard to cost approximately $50,000.

MINNESOTA—Minnesota Mining & Mfg. Co., 900 Fauquier Ave., St. Paul, manufacturer of cellulose products, sandpaper, etc., plans addition to local plant, about 400,000 sq. ft. floor space, to cost about $2,500,000, with machinery and electrical equipment. It will be carried out as a post-war project. Plans also are under way for new mill for manufacture of color-quartz roofing granules on site to be selected in south, comprising several buildings, with mechanical and electrical equipment for large output. A power house will be built. Cost about $1,500,000.

IOWA—Light and Power Department, Harlan, will receive bids until April 18 for extensions and improvements in municipal power plant, including installation of new 1,500-hp. diesel engine-driven generating unit and auxiliary equipment.

MARYLAND—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans new power substation at Naval Training Station, to cost approximately $49,000. Also new one-story general shops building, estimated at $647,000, with mechanical and electrical equipment; and extensions in boiler plant to cost $35,000. Appropriations have been authorized, and work is scheduled to be carried out in near future.

OHIO—Jack & Heintz, Inc., 17600 Broadway, Cleveland, manufacturer of aircraft starters, will carry out expansion in plant for production for government, including additional buildings, with installation of machinery and electrical equipment. Cost about $1,200,000, with financing by Defense Plant Corporation. Work will begin soon.

NEBRASKA—Light and Water Department, Peru, plans extensions in distribution system. Permission has been granted by State Railway Commission and work will begin soon.

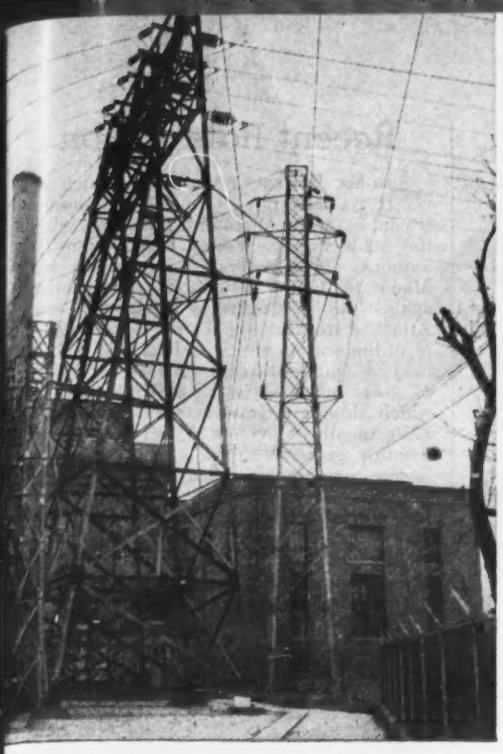
IOWA—Interstate Power Co., Dubuque, has plans maturing for new addition to steam-electric generating station, with installation of additional equipment for increased capacity. Contracts are being awarded for steel reinforcement and other structural work. Sargent & Lundy, 140 South Dearborn St., Chicago, Ill., are consulting engineers.

NEW HAMPSHIRE—Bureau of Yards and Docks, Navy Department, Washington, plans extensions and improvements in power plant and electrical distribution system at navy yard, estimated to cost about $450,000, with equipment. Also will make extensions and changes in certain yard buildings and facilities for increased ship repair capacity, to cost about $700,000, with mechanical and electrical equipment.

NORTH CAROLINA — War Department, Washington, D. C., has authorized expansion at Camp Butner for conversion of station hospital to general hospital, including additional buildings for development of a convalescent center, with electric light and power facilities, comprising underground and overhead distribution lines, exterior and interior lighting, electric elevators, air-conditioning apparatus, fire alarm and other equipment. Entire project is estimated to cost about $1,780,000, and will be carried out under supervision of U. S. District Engineer Office, Savannah, Ga. Proposed to begin work at early date.

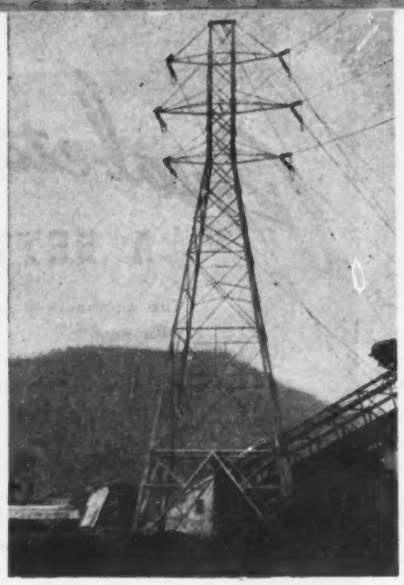
INDIANA—Light and Power Department, Peru, has rejected bids recently received for 1,500-hp. boiler for installation in municipal power plant and will take new bids soon. This is part of station expansion for increased capacity, entire project estimated to cost about $600,000. Bevington-Williams, Inc., Knights of Pythias Bldg., Indianapolis, is consulting engineer.

FLORIDA—Bureau of Aeronautics, Navy Department, Washington, D. C., plans modernization and expansion in central power plant at naval air station, with installation of additional equipment, estimated to cost about $950,000. Extensions and improvements will be made in electric power and communication cable system, to cost approximately $300,000, and in electrical distribution system, to cost $100,000. Switching station in Bldg. 47, will be improved; cost about $116,000. Work will be carried out under direction of Bureau of Yards and Docks, Navy Department, Washington, and is scheduled to be placed under way at early date. Appropriations have been authorized.



A tight-spot installation is typified by the new 113-foot angle tower at the extreme right. Anchored to its top are the power house double-circuits which here separate into two single circuits; one top-level circuit is diverted back of the old river crossing tower to the substation; the other is dropped some 30 feet and routed under power lines of the river crossing to the substation. The old river crossing tower and adjacent substation were also American Bridge projects.

Typical double-circuit tower carrying transmission lines over the roof of the power house. The unusual flare at the base provides direct connection and anchorage to existing roof trusses under the roof covering.



Double-circuit strain and angle tower, about 120 feet high, located between two existing substations and to clear storage yard conveyor systems.

A special type single-circuit, 57-foot, strain tower provides for an acute angular change in the transmission line from the power house to the substation.

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DUE to increasing war loads, a recent expansion to generating capacity of an existing electric plant also involved the installation of additional circuit lines for distributing the new power to existing substations and main transmission lines.

The installation of supporting towers for the new circuits, because of limited ground space and overhead clearances imposed by existing structures and a complicated network of power lines, *and the need for quick action,* posed many unusual and difficult engineering and construction problems. All were satisfactorily solved, and with dispatch, by our tower department's technical staff in collaboration with the power company's engineers.

Because of the zigzagging course of the new circuits—around, over and under existing structures and power lines—each tower and its foundation were individually designed and tailored to prevailing site-conditions and to loadings from horizontal and vertical angular changes in alignment.

Pictured here are four of the many tower types designed and fabricated by American Bridge for this particular project. They are indicative of the accumulated experience and ingenuity of our tower engineers, and the fabricating and galvanizing resources of our tower plant.

In emergencies such as this, and when the time comes for postwar construction, both services are yours to draw upon.

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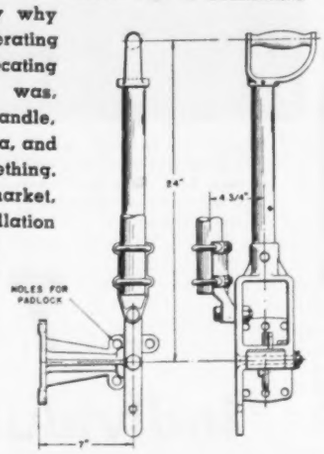

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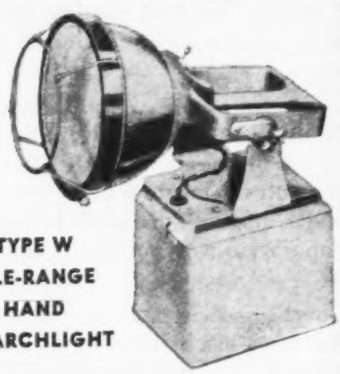

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Recent Rate Action

SHO-ME POWER COOPERATIVE, which recently reduced rates to its 9,000 consumers in 51 south Missouri towns, has asked the state Public Service Commission for authority to raise rates at Cabool and Mountain Grove to absorb taxes levied against the cooperative by those two towns. Attached to the application were copies of ordinances in which Cabool laid a $250 monthly charge against Sho-Me for rental of areas occupied by power lines, and in which Mountain Grove assessed an optional $250 monthly levy or 6 percent of the monthly gross receipts as an occupational license tax. Sho-Me asked authority to prorate the additional charges in each of the two towns and add them to customers' monthly bills for electric service. If customers in Mountain Grove and Cabool do not pay the added charges, the costs would have to be borne by all the co-op's consumers in the 51 town area.

AKRON, (OHIO) CITY COUNCIL is considering a new street lighting contract with the Ohio Edison Co., which gives the city $200,000 and a five-year electric rate franchise which cuts commercial rates 10 percent. The proposal of the company was submitted after Mayor Charles E. Slusser had asked a local utilities excise tax toward balancing the 1945 appropriation, and permitting the city to strengthen its financial position by ending bond refunding. By slashing city street lighting costs by $200,000, the company would, in effect, be putting an equal sum into the city's general operating fund, it was pointed out.

NOVA SCOTIA LIGHT & POWER CO. has been ordered by the Nova Scotia Public Utilities Board to reduce its rates in Halifax $425,000. The decision of the board is for a reduction of 20 percent in the first block, which covers a consumption of 200 kw.-hr. and with minimum bill of $2.50. The reduction will bring the minimum to $2. There will be a rate reduction of 60 percent on all kilowatt-hours above the first block. The board has allied the town of Dartmouth and village of Bedford with the Halifax division, thus applying the rate reduction to both those sections. The board decided the rate base for 1944 was $4,244,213. The depreciated value of all properties owned by the company was $4,164,213 at the end of 1944.

SASKATCHEWAN POWER COMMISSION has announced a general rate reduction, according to J. L. Phelps, Minister of Provincial Resources for Saskatchewan. The reduction affects service charges and maximum energy rates, and will, it is claimed, result in a saving of $40,000 for customers of the commission. The maximum service charge for lighting will be cut from $1.25 to $1. The maximum energy rate for the first block will be reduced from 15 cents to 12 cents per kilowatt-hour and other reductions will be made below 12 cents an hour "where such reductions are required to make rates equitable."

ONTARIO HYDRO announced last month the fifth reduction in rates to Windsor residential consumers and the third to commercial and power users since the outbreak of the war. According to W. P. Bolton, chairman of the Windsor Utilities Commission, the new rate reductions will mean an annual saving to consumers of $150,418. Of this sum, the domestic consumer will receive $56,546, while the bills to commercial and power consumers are reduced $22,765 and $71,107, respectively.

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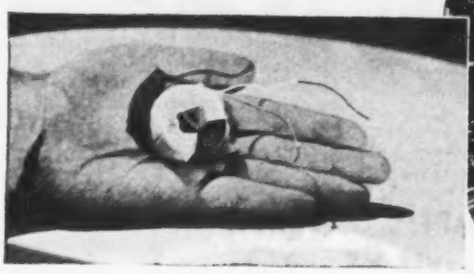

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Recent Legislation

ARKANSAS—Senate went on record as urging that the three government-owned plants in the Hot-Springs area— the Jones Mill aluminum plant, Hurricane Creek alumina plant and the uncompleted Lake Catherine power plant—be owned and operated by private enterprise. The Senate endorsed the opinion that "private enterprise is preferable to public construction and operation." The resolution, which will now go to the House, also urged completion by private enterprise of the unfinished power plant on Lake Catherine, which is not now in operation.

INDIANA—House passed unanimously a bill which would amend the municipal corporation act to permit second-class cities operating two or more utilities to create a municipal utility employees' pension fund. However, a House bill which would have placed employees of municipal utilities in cities of 115,000 to 150,000 population under civil service was killed via the indefinite postponement route.

MARYLAND—The second bill in the Legislature to give the Public Service Commission jurisdiction over the erection of high-voltage electric power lines is dead. Delegate John C. Luber, chairman of the House Ways and Means Committee, reported that the committee has unanimously voted an unfavorable report on the House version of the bill, and that it will not be brought to the floor. A similar measure, introduced in the Senate early in the session, now reposes in the files of the Senate Finance Committee, where it is expected to remain.

MASSACHUSETTS—House is considering a bill which would prohibit electric and gas companies from selling appliances. The bill was placed in the orders of the day by action of the House in rejecting an adverse report from the committee on power and light.

NEBRASKA—Two power bills, introduced by Senator Raecke, chairman of the Legislature's special power investigating committee, have been passed by the Legislature. LB43 provides that a vote of the people within a power district must be had before a district can sell, lease or transfer any property to a private, or a public agency operating in more than 13 counties, except under certain conditions. LB44 authorizes the State auditor to accept audits of rural electrification district that are made by Federal auditors.

NEW YORK—Governor Dewey has approved a budget bill to amend the tax law in relation to the distribution to cities of certain revenues from the emergency tax on utility services. The Governor has approved the Magnuson Bill as Chapter 181 laws of 1945, amending section 364 General Municipal Law to provide municipal corporation furnishing public utility service need not decrease its rates and charges on order of Public Service Commission unless order is issued upon notice and after hearing instituted by not less than 25 active consumers residing in territory in which rates apply.

NORTH CAROLINA—Bill has been introduced in the Assembly to extend the authority of the State Utilities Commission over refinancing of utility securities. The bill provides that any refinancing by a utility company may be made in the manner and to the extent approved by the commission, provided the proposed transactions are found by the commission to be in the public interest and in the interest of consumers and investors, and provided that any redemption should be at prices not less than par.

NORTH DAKOTA—The bill sponsored by the North Dakota Commission to establish the prudent investment method for the valuation of public utility property for rate making purposes has been enacted into law. It was signed by Governor Fred S. Aandahl last month. Among other things, the new act specifically repeals Section 49-0602 of the North Dakota Revised Code of 1943, which the North Dakota Supreme Court had held requires a determination of the reproduction cost of public utility property in a rate proceeding. The newly approved basis of valuation is set forth in the first two sections of the act, as follows: "Section 1. The value of the property of a public utility, as determined by the Public Service Commission for rate-making purposes, shall be the money honestly and prudently invested therein by the utility less accrued depreciation. Section 2. The value of public utility property for rate-making purposes shall not include or be affected by good-will; going concern value; or franchise value in excess of payments made therefor."

TENNESSEE—Governor McCord has signed three bills covering the assessing of public utilities. The first would provide that the Railroad and Public Utilities Commission assess the utilities during even rather than odd years, while the second bill would require the utilities to file their property schedules in the even years. The latter act provides that the utilities have until June 1 this year to file their schedules, but in succeeding years they must be filed by April 1. The third act permits states, counties, municipalities, property owners and any user to file exception to the assessments set by the Utilities Commission. A bill that provides for the establishment of a state electrical board died in committee rooms after its introduction in both houses. Proposed legislation was sponsored by the Tennessee State Electrical Workers Association.

TEXAS—House of Representative committee on state affairs unfavorably reported the bill to establish a state board of electrical examiners to enforce standards of proficiency and quality.

WASHINGTON—A bill passed by the Legislature splits the Department of Public Service into Departments of Transportation and Public Utilities, with directors to be appointed by the Governor.

CANADA—A bill has been introduced in the Nova Scotia legislature setting a definite basis for valuing any public utility expropriated by the Nova Scotia Power Commission, a subsidiary of the (provincial) government. The bill provides amendments for the power commission act. Compensation is to be based on "the prudent original cost of the undertaking," after deduction of the accrued depreciation of the property and its assets.

•

Coast Utility Calls Bonds

Portland General Electric Co. has called for redemption on April 5, all of its outstanding first mortgage 5 percent bonds, due by extension in 1950, at 100½ and accrued interest. Payment will be made at the principal office of Bankers Trust Co., New York, successor trustee.

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BOOK REVIEWS

Air Compressors, by Eugene W. Feller, published by McGraw-Hill Book Co., New York, N. Y. 460 pages, illustrated. Price, $4.50.

A descriptive treatment of the various types of reciprocating, rotary and centrifugal compressors with considerable design, application and perfomance information. It is in simple language for the operating man and it should prove real helpful to maintenance men because of the explanation of the principles of action. The author, a member of the editorial staff of *Power*, has included almost a whole chapter on the gas turbine in conjunction with the axial compressor.

Electrical Drafting by D. Walter Van Gieson, published by McGraw-Hill Book Co., New York. 140 pages. Price $1.50.

Duplicating none of the field of mechanical drawing this brief book deals evclusively with the systematic, intelligible portrayal of electrical circuits. Symbolization is that of the ASAZ 32 program of 1942-1944 (except for the wartime transformer conventions adopted late in 1944). In textbook style (problems and quiz questions included) the subject matter treats light and power, communication, switchboard, ship aircraft, sign and signal wiring circuits for the beginner and trainee.

An Introduction to Electronics by Ralph G. Hudson, published by The Macmillan Company, New York. 97 pages, illustrated. Price $3.00.

Without recourse to mathematics or abstruse physics this well-known M.I.T. professor has set forth for the non-technical man in rigorous explanation the basis, the ramifications and the potentiality of electronics. Industrialists, power salesmen, and copy-writers are the audiences addressed and they need only a willingness to accept the precise language and the diagrammatic exposition of the scientist in order to receive the evolution of the tools of electronics and what they have achieved and can achieve in radio, facsimile, television, sound recording, illumination, medicine, navigation and industrial control.

Modern Stores, 1945. Published by National Retail Furniture Association, 666 Lake Shore Drive, Chicago 11, Illinois. 160 pages, paper covers. Price $2.50.

Designs of furniture stores particularly, but applicable to many others. Well illustrated discussions of store fronts, windows, interiors, department displays, lighting, use of color, store offices and services, remodeling, air conditioning. Should be useful to utility salesmen calling on commercial customers.

International Tribunals, by Manley O. Hudson. Published by The Brookings Institute and The Carnegie Endowment for International Peace, Washington, D. C. 287 pages, price $2.50.

A century and a half of international tribunals is analyzed by a judge of the Permanent Court of International Justice to find their steps of progress, their impediments and vicissitudes and prospects for broader and more effective functioning. He concludes "a long road must be travelled" but that they "can help to build on solid foundations a world order based on law." Electrical individuals and commercial enterprises will find special interest in the procedures discussed in connection with the two chapters on international claims tribunals and the frequently proposed international commercial tribunals.

ELECTRICAL ENGINEER

For old established eastern manufacturer. One who can manage transformer department, and understands all phases of transformer design and building. Only engineers thoroughly familiar with building and calculating on all types of air and oil cooled transformers need apply. Steady position and good salary to right man.

P-832, Electrical World
330 West 42nd St., New York 18, N. Y.

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PRODUCTION ENGINEER — fractional h.p. electric motors. Should have specialty background in single phase motors, having devoted major effort to efficient mass production. Line will have limited size range. Engineering design experience desirable for development of motors for tooling and production. Permanent connection with outstanding Southern California manufacturer entering household appliance field. Send detail of experience and personal qualifications to A.W.A., Box 68, Station K, Los Angeles, California.

POWER AND Commercial sales engineers. Large utility in Central Southwest has openings for several permanent employees—excellent prospects and opportunities for advancement. Send details of education, experience, draft status, age and availability to P-840, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL DRAFTSMAN, experienced in overhead distribution and substation design; also meter and relay technician, thoroughly competent to repair all types of protective relays, watthour and demand meters and laboratory equipment. Location, Northern Alabama. In reply state experience, age, references, salary desired and when available. P-845, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: Electrical Engineering graduate for permanent position in Electrical Department of a large steam generating station. Plant is operated by a Public Utility Corporation located in the East. P-846, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL DRAFTSMAN, experienced in overhead distribution and substation design, for location in Northern Alabama. In reply state experience, references, salary desired and when available. P-847, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

A TEXAS Utility Company needs three experienced graduate electrical engineers for planning, design, and operation of overhead and underground distribution systems. In replying, please state age, education, experience, and salary expected. P-848, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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SALARIED POSITIONS — This advertising service of 35 years recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission's. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo 2, N. Y.

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POSITION WANTED

SYSTEM PLANNING Engineer, over 20 years experience electric utilities and manufacturing. Planning, design, economic studies, testing, field surveys. Desires Midwest connection, planning supervisor or executive assistant. PW-849, Electrical World, 330 W. 42nd St., New York 18, N. Y.

SALEMAN WANTED

SALES ENGINEER—Canada to reside in Montreal or Toronto and travel throughout Canada. Promotional engineering sales work overhead conductor material. Canadian preferred, age 35-40, with good professional background design, construction of distribution and transmission lines. Salary plus traveling expenses. Write giving qualifications and salary expected. SW-850, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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Division Sales Managers
Supervisors

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Men Who Can Specialize in Selling:
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Air Conditioning
Industrial Heating

Age limit 25 to 40. College training desirable. In first letter give complete information about training, experience, names of former employers, how long employed by each, who to write for reference, age, number of dependents, salary expected, how soon available. Send picture.

SW-843, Electrical World
520 North Michigan Ave., Chicago 11, Ill.

WANTED

To Purchase Electric Utility in small community under 2000 population. Either steam, Diesel or High Line source.

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By Large Pioneer Transformer Manufacturer

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SW-844, Electrical World, 330 West 42nd St., New York 18, N. Y.

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Chicago 11, Illinois

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Electrical—Mechanical—Structural

We have openings for capable engineers and draftsmen in the following branches of engineering—

ELECTRICAL—Industrial lighting, Power distribution, and Electronic controls and devices.

MECHANICAL—Power plants, Heating systems, Process piping, Conveying systems, Plumbing, Sewers, Sprinkler work, and Precision machine design.

STRUCTURAL—Industrial buildings, Power plants, and Miscellaneous structures of steel and reinforced concrete.

Opportunities are in the West Coast, Cleveland, Chicago, New York and Gulf Coast areas.—Vital war plants important to the United States Government under high priority ratings.—Recent graduates will be considered.

Applicants must conform with Local War Manpower Regulations.

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An established Boston engineering firm has an opening for an assistant to the head of the Mechanical Engineering Department. Applicant should have had experience in making Studies, Surveys and Reports on Steam Power Plant and Process Steam Problems.

This man should be 30-35 years old, a college graduate with a knowledge of design and operation of Steam Power Plants.

Give complete experience record with salaries previously received and expected salary. Excellent opportunity with a future for the right man. **Statement of Availability Required.**

P-835, Electrical World
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Experienced in initiation and development of design, and in preparation of sketches and construction drawings, cost estimates and bills of material, for work on hydroelectric projects and high-tension switchyards. Do not apply unless competent in responsible design position. Send by airmail to **Mr. Antonio Lucchetti,** Executive Director, **Puerto Rico Water Resources Authority, San Juan, Puerto Rico,** for application blank.

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Man thoroughly experienced in flashlight battery production, process and equipment, to supervise erection and operation of dry cell battery plant abroad. Excellent opportunity for high-calibre man.

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Plaza 5-1953 420 Madison Avenue, New York 17, N. Y.

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BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS
We rewind, repair and redesign all makes and sizes.
One Year Guarantee

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"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

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Experienced electrical men, familiar with low voltage distribution systems to act as sales specialists in important District Offices on following: Panelboards, safety switches, enclosed circuit breakers, bus duct and load centers. Men accepted to receive full training at factory at company's expense before assignment. Write to Supervisor, Technical Employment, 306 Fourth Avenue, Pittsburgh, Pennsylvania, for application form.

WESTINGHOUSE
Electric & Manufacturing Co.

...ALE «

LOCOMOTIVES

40-Ton American and 30-Ton Vulcan saddle tank locomotives. Many other sizes and types.

CARS

All kinds of railroad and dump cars.

CRANES

Locomotive, truck and crawler cranes —5 to 35 tons capacity.

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Allis-Chalmers, Model K, with and without blade. International Model T-20 with blade.

TRUCKS—TRAILERS

Trucks and truck trailers of all kinds.

HOISTS **COMPRESSORS**
DERRICKS **GENERATORS**

THE HARVEY LEFEVRE CO.
500 Fifth Ave. New York 18, N. Y.
Telephone PENNSYLVANIA 6-3175

Rotary Converters—3 Ph. 60 Cy.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	2300
1—1000	Whse.	900	600	2300
2— 750	Whse	1200	600	2300/4000
1— 500	G.E.	1200	600	13200/2300

Rotary Converters—3 Ph. 25 Cy.

2—1500	G.E.	500	225/275	6600
1— 500	G.E.	750	225/275	6600

M. G. Sets—3 Ph. 60 Cy.

1—1500	G.E.	360	250	2300/4600
1—1000	G.E.	720	250	2300/4150
1— 500	G.E.	720	600	13200
1— 400	G.E.	720	250	2300
1— 200	G.E.	720	125	440

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Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.
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USED MACHINERY

All in good operating condition

Immediate delivery

2—Ingersoll-Rand, Cross Compound Air Compressors. Imperial Type. Size 12"x12"—12"x7½"x with 60 H.P. 2300 V., 3 Phase, 60 Cycle, Slip Ring Motors, complete with controllers, etc. Also each with 2i ft. G & K Double Leather Belt.
3—Motor Driven Centrifugal Pumps.
2—300 G.P.M. Platt Iron Wks. Size 4, 334 Ft. Hd. with 50 H.P. Ft. Wayne 2300 V, 3 Phase Motors.
1—600 G.P.M. De Laval Cent. Pump, with 75 H.P. G.E. 3 Phase, 2300 V, 60 Cycle, Slip Ring Motor and Controller. Grid Resistance, etc.

For further information address
W. W. POINTER, Supt.
UTILITIES, TROY, ALA.

J.L.HEMPHILL & CO. Inc.
ELECTRICAL ENGINEERS AND EQUIPMENT
1602 53rd Street, North Bergen, N. J.
N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2660

MOTORS

3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—350 HP, 300 RPM, 440 volt, G.E. slip ring
1—225 HP, 1800 RPM, 220 volt, G.E. slip ring
1—200 HP, 600 RPM, 440 volt, Crocker Wheeler slip ring
1—200 HP, 600 RPM, 2200 volt G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E. sq. cg.
2—150 HP, 1200 RPM, Westinghouse, squirrel cage
2—150 HP, 1800 RPM, 220 volt, Westinghouse slip ring
1—100 H.P. 1800 R.P.M. 440 volt, General Electric, squirrel cage
1—60 H.P. 1200 R.P.M. 2200 volt, General Electric, slip-ring

D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—350 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—150 HP, 500 RPM, General Electric, MPC.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 575 RPM, General Electric
3— 50 HP, 700 RPM, Crocker-Wheeler

VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electric Dynamic.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker-Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
2—25 HP, 650/2200 RPM, Westinghouse.
2—25 HP, 200/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, General Electric.
1—13/18 HP, 250/1200 RPM, Electro Dynamic.
1—10 HP, 400/1600 RPM, Westinghouse, SK.
1— 5 HP, 450/1800 RPM, Crocker-Wheeler.

MOTOR GENERATOR SETS

1—75 KW, 125 volt, General-Electric, squirrel cage.
1—15 K.W. 250 volt, G.E. squirrel cage.

TRANSFORMERS

2—400 KVA, G.E. 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh 7800/440 volt.
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
2—100 KVA, G.E. 2200/220/440.
2— 75 KVA, General Electric 3 phase, 4150 Y, 120/208Y.
3— 50 KVA, Pittsburgh 2200/220/110.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 250 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—30 KW, 125 volt, Allis Chalmers.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator. Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

FOR SALE

ROTARY CONVERTERS

2—2600-kva, GE Rotary Converters, 250/300-volt, d-c, 8670-amp, type HCC-24-2600-300, form P, 300 rpm, d-c starting, serial #842144 & #764980. GE Alternating Current Booster Generator, type AH-24-217-300, form P, 300 rpm, 25-volt full load, serial #842145 & 40-volt full load, serial #764984. Each equipped with power transformer, rheostats, panels, blowers. Detailed information furnished on request.

VOLTAGE REGULATORS

1—25-kva, GE, type IRS-2-25-60, form F4, 60-cycle, 2400-volt, 125-amp, serial #438064.

2—300-kva, GE, type IRT-2-300-4800-360, 10% regulation, form A73, 60-cycle, indoor, air-cooled, PV-4800-360-amp, serial #4516817,8. Induction motor operated, GE, type KT-548-8-900, form C, 3-phase, 60-cycle, 220-volt.

SYNCHRONOUS CONDENSER

1—3000-kva Allis-Chalmers, 2300-volt, 754-amp, 3-phase, 60-cycle, 900 rpm, serial #124571.

Exciter: Direct-connected, Allis-Chalmers, 125-volt full load, 200-amp, 900 rpm, serial #124569.

Starting Motor: Direct-connected, Allis-Chalmers, slip-ring, 100-hp, 2300-volt, type ARY, 3-phase, 60-cycle, 1150 rpm. Control Panel: Cubicle, 9'6" high, 52" side, 48" deep, starting and running switches mounted in cubicle.

CIRCUIT BREAKERS

2—Westinghouse, 0-33, 600-amp, 25000-volt, TPST, solenoid-operated, 125-volt.
2—Westinghouse, CO-2, 600-amp, 24000-volt, TPST, solenoid-operated, 125-volt.
2—Westinghouse, CO-22, 600-amp, 24000-volt, TPST, solenoid-operated, 125-volt.

Miscellaneous lot of spare parts for: GE, FH209, 500-amp, 24000-volt, TPST, circuit breaker.

THE DETROIT EDISON COMPANY
2000 Second Avenue
Detroit 26, Michigan
Salvage Sales Department

FOR SALE

DYNAMOMETER

1—75 HP G.E., Sprague Type TLC, 250 Volts, 775/2500 RPM Laboratory Type with Control Panel. Delivers 50 HP Absorbs 75 HP.

ECLIPSE - PIONEER DIVISION
BENDIX AVIATION CORP.
Teterboro, New Jersey

DIESELS

ROBERT SCHOONMAKER
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Phone Roslyn 1220

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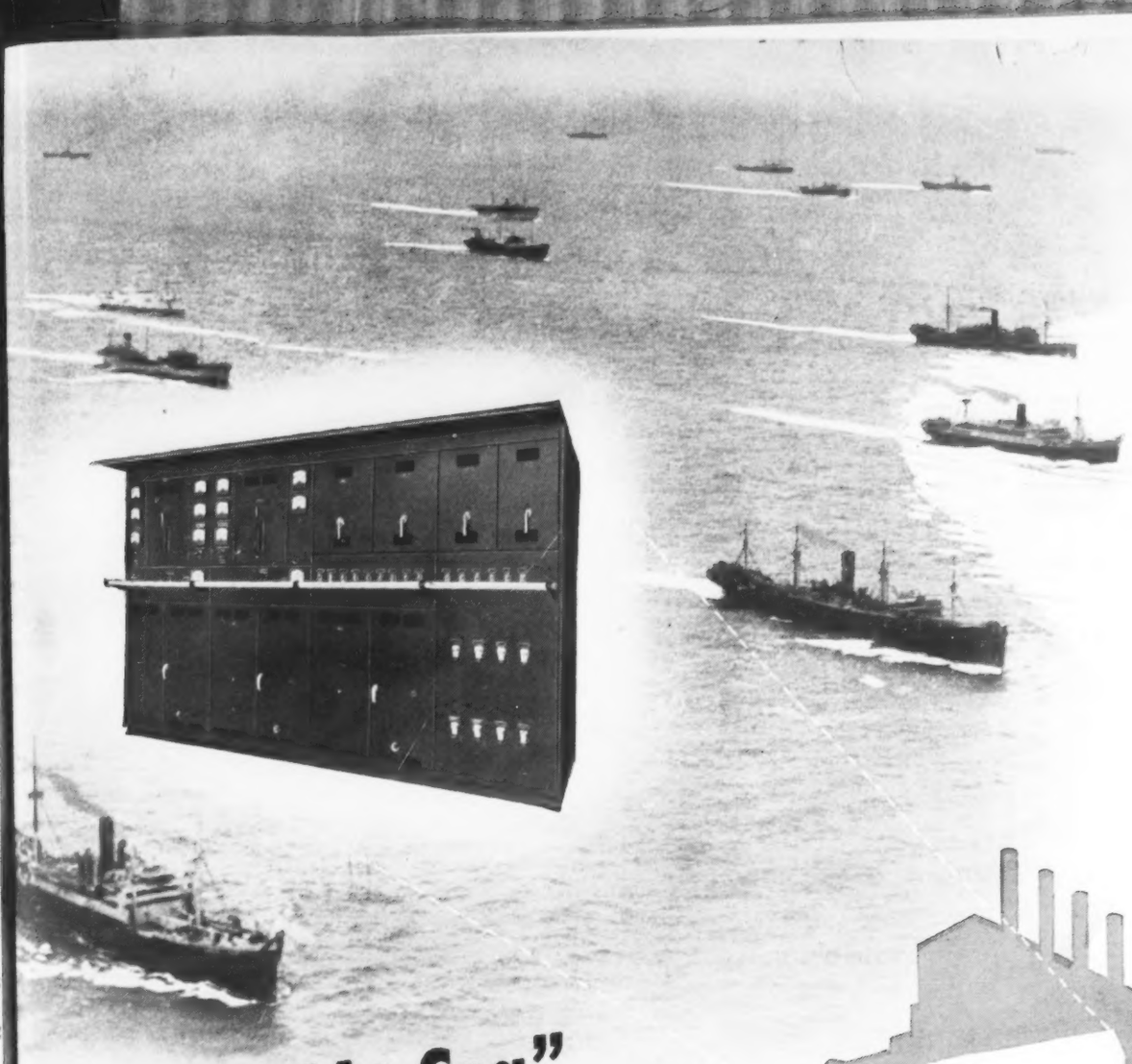
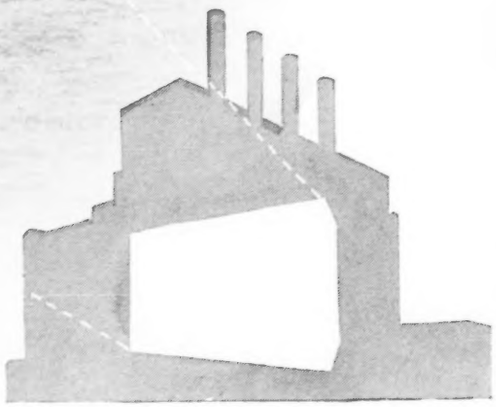




Are you "At Sea" regarding Switchgear?

Literally speaking, we are "at sea" because the Navy has long depended upon I-T-E for circuit breaker protection. Even when Theodore Roosevelt sent the Great White Fleet around the world, it was equipped throughout with I-T-E air circuit breakers, and in World War I, our fleet was similarly protected. This heritage imposed a tremendous load on us when World War II started because protection by air switchgear has continued to be a basic requirement for merchant marine as well as fighting ships.

We are also "at sea" in another way. While building for the Navy we can not adequately serve all our customers old and new. Even though our facilities and manpower have been doubled, and doubled and doubled, deliveries to industry are limited to a few top priorities. This has been a matter of great concern to I-T-E and we look forward to the day when we can again supply your switchgear requirements. Until then, all our resources must be devoted to filling the nation's most urgent war needs. However, don't hesitate to call upon us now for assistance and information regarding switchgear and its application.

HIGH SPEED
CIRCUIT BREAKERS

AUTOMATIC RECLOSING
CIRCUIT BREAKERS

UNIT SUBSTATIONS

SWITCHGEAR

BUS STRUCTURES

I-T-E

AIR SWITCHGEAR

I-T-E CIRCUIT BREAKER CO.

19th and Hamilton Streets Philadelphia 30, Pa.

Should you add old oil to new to prevent turbine corrosion?

the answer is no . . .

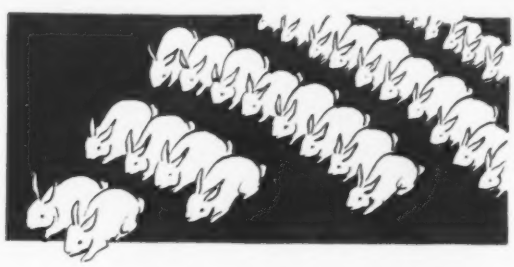
use corrosion-inhibited . . .

NONPAREIL TURBINE OIL

The practice of adding a small amount of used turbine oil to new oil was considered by many turbine operators in the past as the only means of safeguarding turbines against corrosion. The theory was well-founded. Tests show that used oil frequently has much better corrosion resistance than highly refined new oil. This practice effectively reduced corrosion trouble, but like many old-fashioned cures, "The remedy was worse than the sickness."

The principal trouble encountered when adding old oil (even in small amounts) to new oil was due to the fact that the used oil usually had high acidity. It is well known that the rate of acidity formation in turbine oil increases as the acidity increases—like rabbits in a hutch, the more you have, the faster they multiply. Therefore, the introduction of even a small amount of acidity in new turbine oil shortens the life of the oil and increases the need for turbine cleaning and oil treating.

With Nonpareil Turbine Oil it is not necessary to add old oil to new. Effective corrosion inhibitors in Nonpareil adequately protect the turbine against corrosion without the slightest danger of increasing



acidity of the oil. Nonpareil passes the ASTM test D 665-42T for determining the ability of a turbine oil to aid in preventing the rusting of ferrous parts in the presence of water.

Nonpareil is also guaranteed *in writing* not to exceed the extremely low neutralization number of 0.15 mg. KOH/gm. *for the life of your turbine.* This is another safeguard that assures continuous operation of your turbines, free from all lubricating trouble and turbine oil maintenance. A copy of the booklet "What do you want to know about Turbine Oils?" fully explains the advantage of the Nonpareil Guarantee. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for a copy.

Buy more War Bonds

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE